WPS & Inspection Plus

Training course

For Next Generation Controls

Table Of Contents — Pages

- These are the fundamental parts of the probe that are in your machine
- Testing the probes

FUNDAMENTAL PARTS OF THE PROBE

`What is Probing? - Video

OMI (OPTICAL MACHINE INTERFACE)

The OMI is connected directly to your Haas Machine

It communicates with the other two probes by infrared light

It acts as a receiver and sends the signal back to the machine control that the probes have been triggered

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OMP (Optical Machine Probe)

The OMP is a 3D touch triggered probe that is mounted to a machine tool holder. It is used to set up work offsets and inspect parts on your Haas machine. The OMP is usually in a standby mode until it receives a signal to turn on from the OMI.

OTS (Optical Tool Setter)

The OTS is 3D touch-trigger tool setter with optical signal transmission used for broken tool detection and rapid measurement of tool lengths and diameters on a wide range of tools.

Testing Probes

The following program, when run in MDI, will turn on the OTS probe

M59 P2 (OTS Probe)
G04 P1.
M59 P3

When you begin this test the tool probe's LEDs will be blinking green

Tapping the probe with your finger will simulate a hit and the LEDs on the OMI will go from green to red

When you press reset the probe will shut off

The following program, when in MDI mode, will turn on the Spindle Probe

M69 P2 (Spindle Probe)
M59 P3

When you begin this test the tool probe's LEDs will be blinking green

The second line of code will cause the machine to begin moving in the x direction.

Tapping the probe with your finger will simulate a hit and the LEDs on the OMI will go from green to red and will also stop the machine's motion

When you press reset the probe will shut off

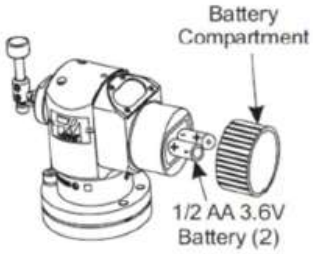
- General battery information
- Spare parts for the probes

[Troubleshooting your Probe Part 1 - Video]

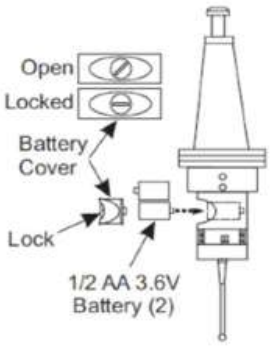
[Troubleshooting your Probe Part 2 - Video]

Batteries

The OMP and OTS each contain (2) ½ AA 3.6V batteries



Renishaw Table Probe



Renishaw Spindle Probe

Checking your Batteries

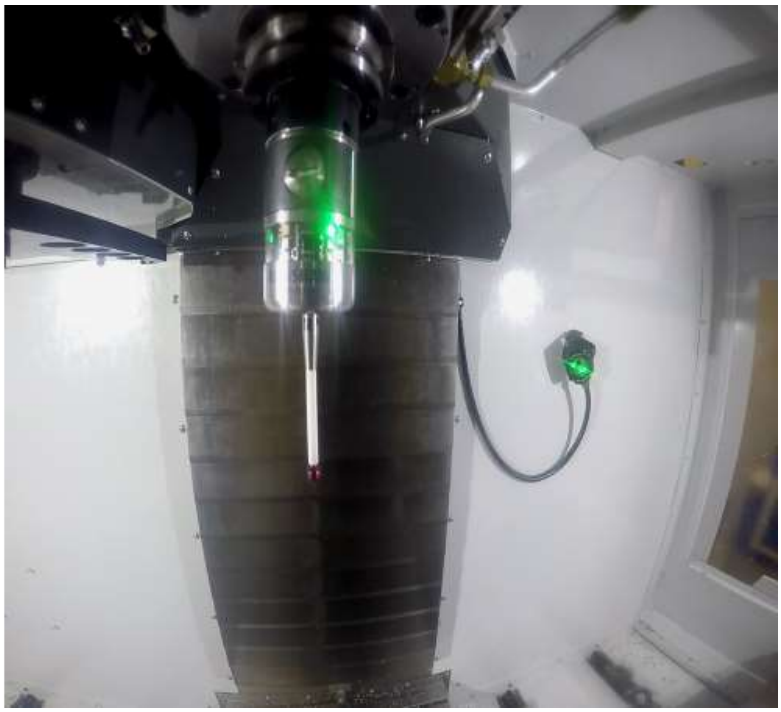
1. Remove batteries
2. Wait 5 seconds
3. Put in batteries and close cap
4. Count LED sequence, at the end of the sequence. (Good batteries will display 5 quick GREEN flashes

Battery life depends on how much the probe is used. The probe only turns on when it's being used. After the probe is done being used in a probing cycle it shuts off to conserve battery life.

Average life of a battery is 250 days if left in standby by mode.

Average life of a battery with it being in continuous use is 230 hours.

Majority of probing problems stem from batteries dying. With the average battery life lasting as long as 3 to 4 months, it is good idea to keep spare batteries on hand.



Spare Parts

Spare/Replacement parts include:

1. Ceramic Stylus (Spindle Probe) - 60-0026

2. Disk Stylus (Table Probe) - 60-0028

3. Stylus Holder (Table Probe) – 60-0029

4. Link Break Protect (Table Probe) – 60-0030

5. Extension (Table Probe) – 60-0034

1. (60-0026)

4. (60-0034)

2. (60-0028)

5. (60-0030)

3. (60-0029)

- How to level and align your probe
- How to calibrate your probe

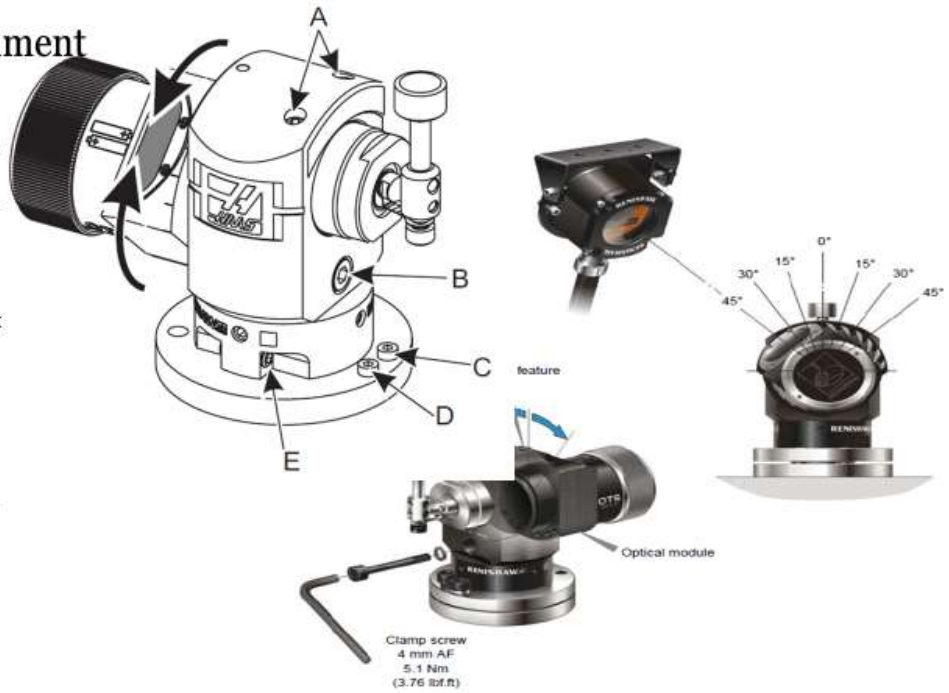
PROBE ALIGNMENT AND STANDARD CALIBRATION

Probe Alignment

The probe can be rotated in increments of 15° and can go up to 45° in either direction to ensure the optical module is pointing towards the receiver by removing bolt B

When making a front to back adjustment, you must loose screw C then use screw D to change the height of the front of the stylus

Be sure to retighten screws after adjustment



Probe Alignment

Side to side adjustment of the stylus can be achieved by adjusting screws A

Stylist should be level within 0.0002”

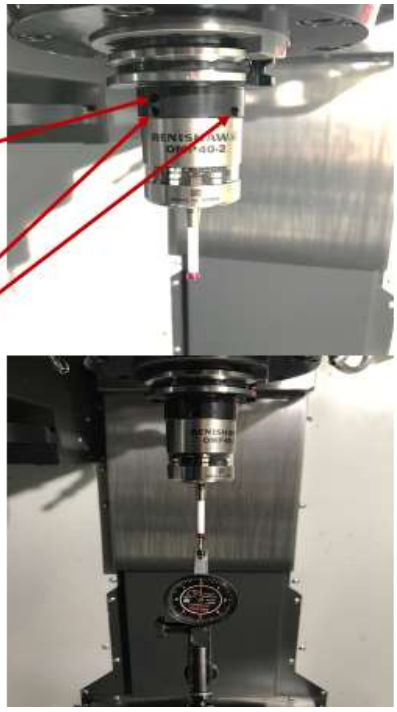
To align OMP you must place an indicator on the ruby and loosen the top two screws and lightly tighten them

Rotate the spindle until the high side is facing you

Set indicator to the High Spot of the Ruby in the Z and X axis

Then loosen the bolt in the back and tighten the bolt in the front (there are 4 total screws used for run-out adjustment)

Repeat until the run-out is less than 0.0002"



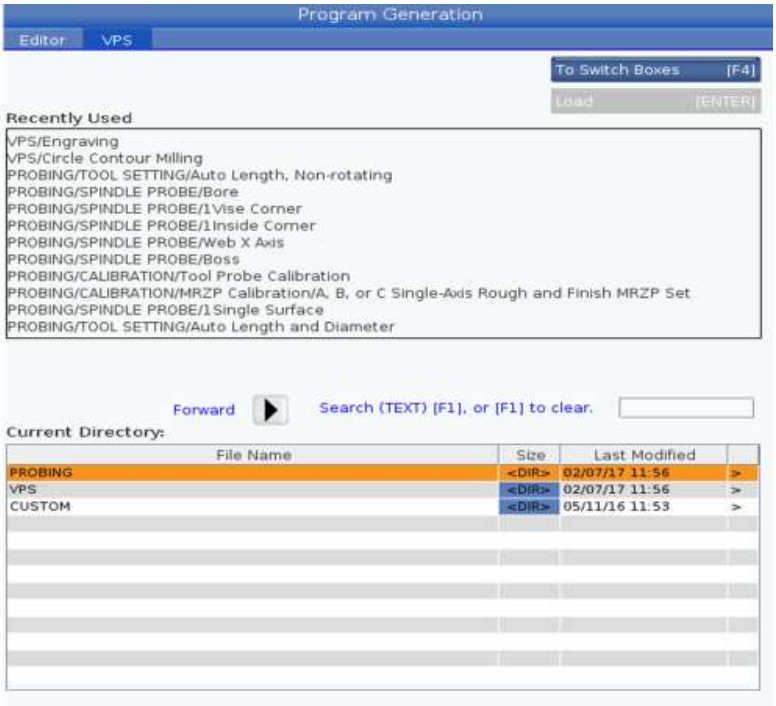
VPS

"Virtual Programming System" is used to calibrate and use the probes in your machine

VPS can be reached in your HAAS controller by going to the edit menu, curser up to the top tabs and going over to VPS

Then you can go down to the directory where you can access probing, VPS and custom

Here you can go down to "PROBING" and curser to the right



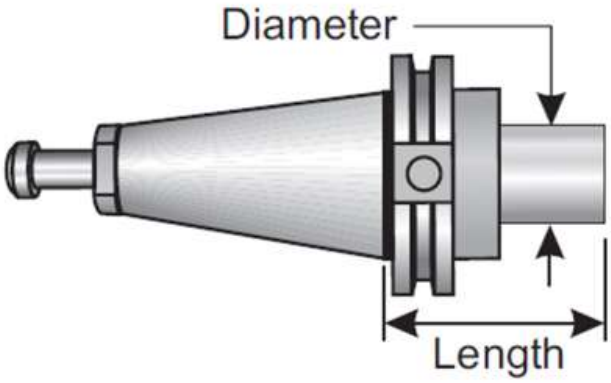
Probe Calibration - Video

Probe Calibration

The first calibration that needs to be done is "Tool Probe Calibration". To begin "Tool Probe Calibration" you must use a calibration bar of a known gauge length and diameter.

This can be easily made using a gauge pin in a tool holder

Position master gauge over OTS stylus about 0.25"



Calibration Bar

Probe Calibration

L: The gauge length of the calibration bar

S: The tool diameter

D: The direction of the OTS

Once these are filled out you hit "CYCLE START" to bring you to MDI mode where you can begin the calibration cycle

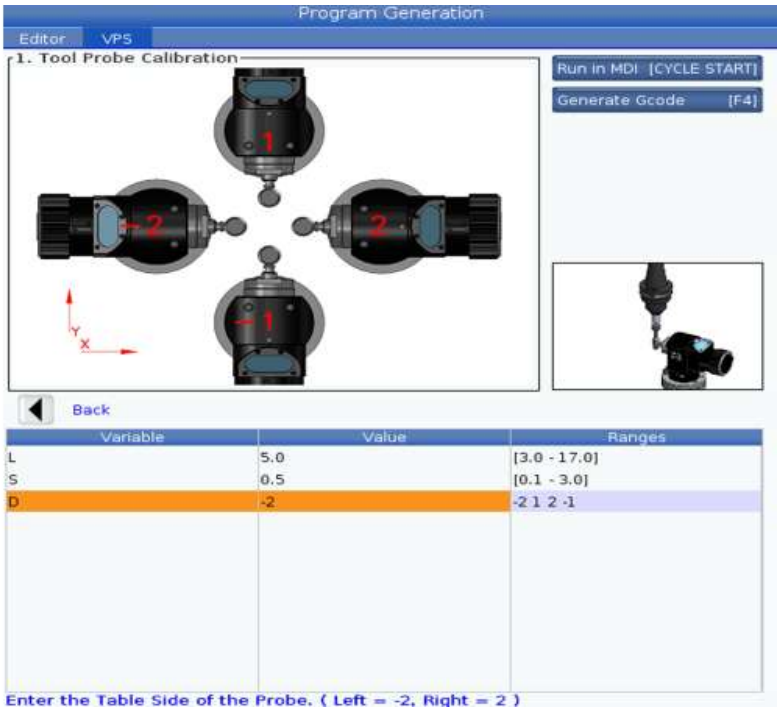
When selecting a direction for your OTS it is important to note the direction of your stylus:

1: The stylus is towards the front of the machine

2: The stylus is towards the left of the machine

-1: The stylus is towards the back of the machine

-2: The stylus is towards the right of the machine



After you complete "Tool Probe Calibration" you have to go back to the calibration page and go to "Spindle Probe Length Calibration"

Once you select this option you will require to put in:

T: Tool Number

Once selected you can "CYCLE START" to run the "Spindle Probe Length Calibration" in MDI mode

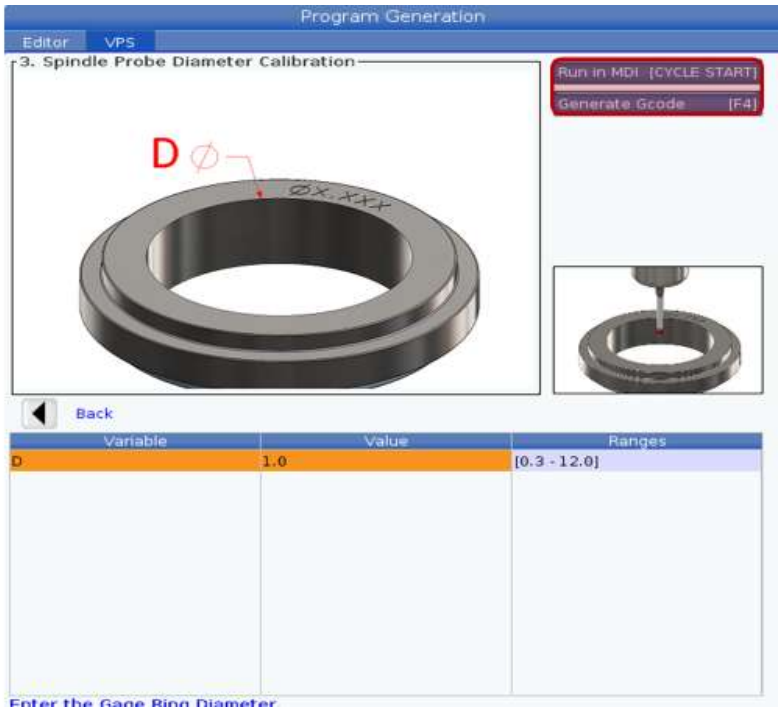
Once that is compete you must go down to the next option, “Spindle Probe Diameter Calibration”. To do this you will need a ring gauge with a known diameter

Be sure to position the probe inside the ring gauge. Bring the probe down approximate center of the gauge and enough that the ruby will measure on its widest diameter

Once you select this option you will be required to input:

D: The inner diameter of the gauge

Once the diameter is put in you can hit “CYCLE START” to run the “Spindle Probe Diameter Calibration”



Below the “Spindle Probe Diameter Calibration” you have the option to do a “Complete Probe Calibration”. This option is an alternative to running through the previous 3 steps.

You will have to bring the Calibration Bar to 0.25” above the OTS stylus

Once you select the “Complete Probe Calibration” you will have to input all of the information from “Tool Probe Calibration” and “Spindle Probe Length”

The probe will use the OTS stylus to check the diameter instead of a ring gauge

- This section will go through the various probing templates built into your HAAS machine

VPS PROBE TEMPLATES

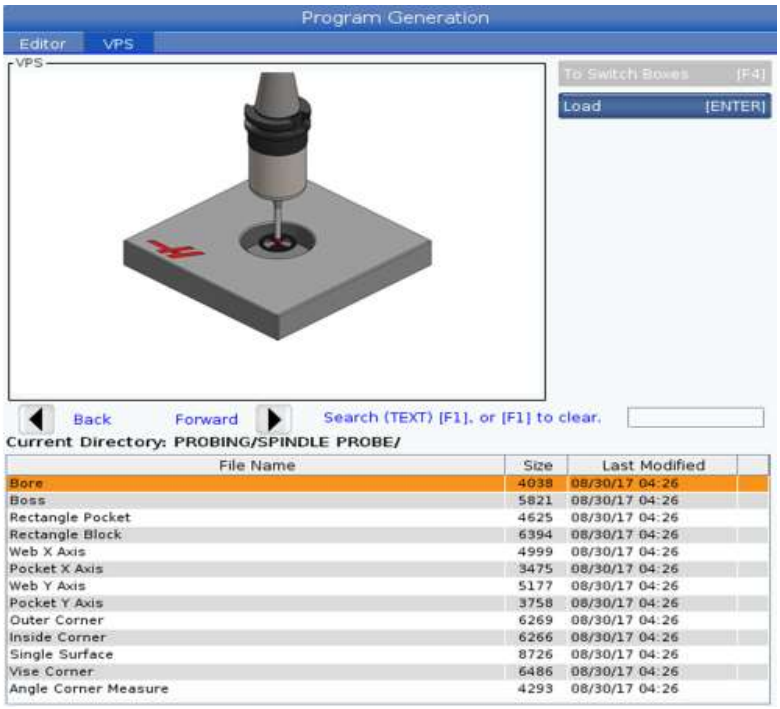
VPS Templates

On NGC: If you return to VPS, curser over to the probing section, you can then select "SPINDLE PROBE"

Once "SPINDLE PROBE" is highlighted curser to the right

Here you will be given a variety of options that will allow to you to set a zero position on your part

On the NGC you can fill out a template, go to handle jog to go to the required location and then return to the template. The template will remain filled out



Setting Work Offsets - Video

Bore is used for finding the center of circular pocket

Before you select this option, you need to position the probe in the approximate center of the circle and low enough that the entire diameter of the ruby will touch

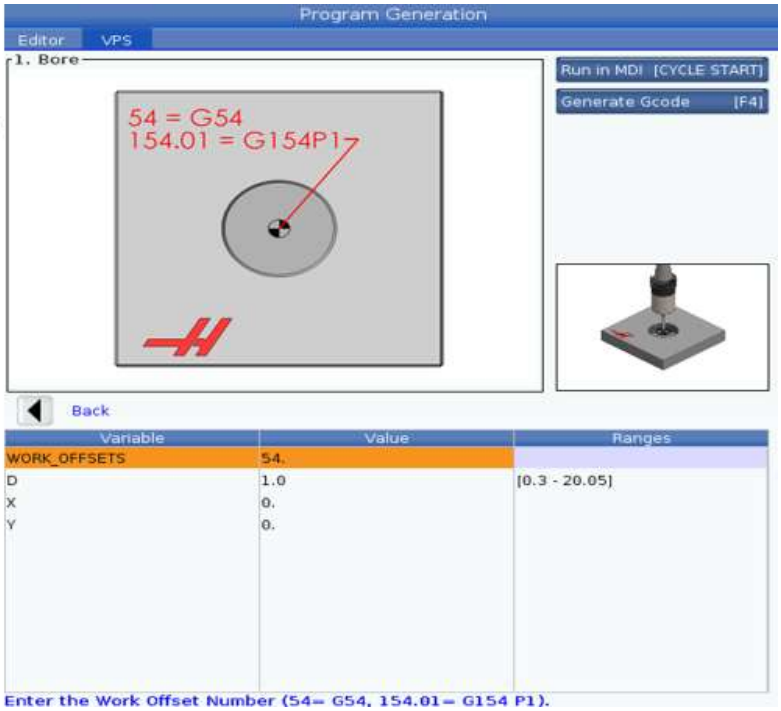
Once selected you be required to input:

WORK_OFFSETS: The work offset you want to work in

D: The diameter of circular pocket that you are probing

X: The distance you want the zero to offset in the X-direction in reference to the center of the circle

Y: The distance you want the zero to offset in the Y-direction in reference to the center of the circle



Boss is used to find the center of an extruded circle

The probe should be placed in the approximate center with an approximate known distance of clearance

Once selected you will have to input:

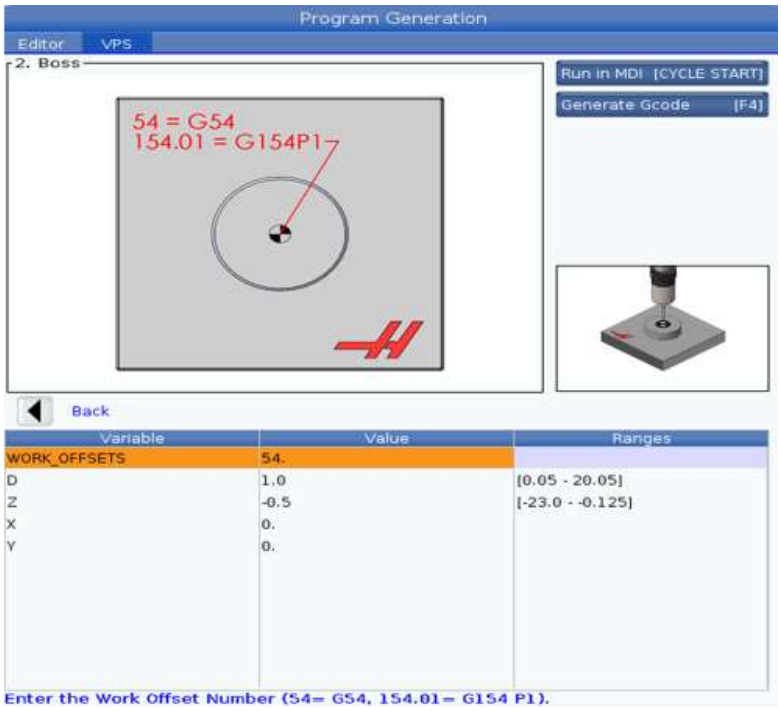
WORK_OFFSETS: The work offset you want to work in

D: The diameter of the extruded circle

Z: The distance the probe needs to go for the largest diameter of the ruby to hit

X: The distance you want the zero to offset in the X-direction in reference to the center of the circle

Y: The distance you want the zero to offset in the Y-direction in reference to the center of the circle



Rectangular pocket is used to find the center of a pocketed rectangle

Before you begin, the probe should be positioned approximately in the center of X and Y and low enough for the ruby's entire diameter to hit

Once selected you will have to input:

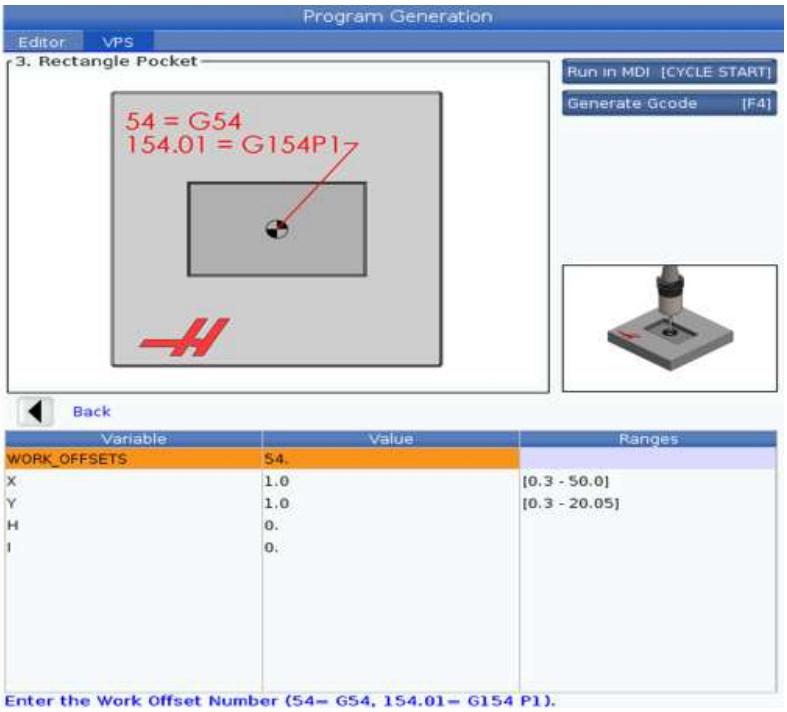
WORK_OFFSETS: The work offset you want to work in

X: The length in the X-direction

Y: The length in the Y-direction

H: The distance you want the zero to offset in the X-direction in reference to the center of the rectangular pocket

I: The distance you want the zero to offset in the Y-direction in reference to the center of the rectangular pocket



Rectangular Block is used to find the center of an extruded rectangle

Before beginning, the probe should be positioned in the approximate center of X and Y with a known clearance above the part

Once selected you will have to input:

WORK_OFFSETS: Your work offset number

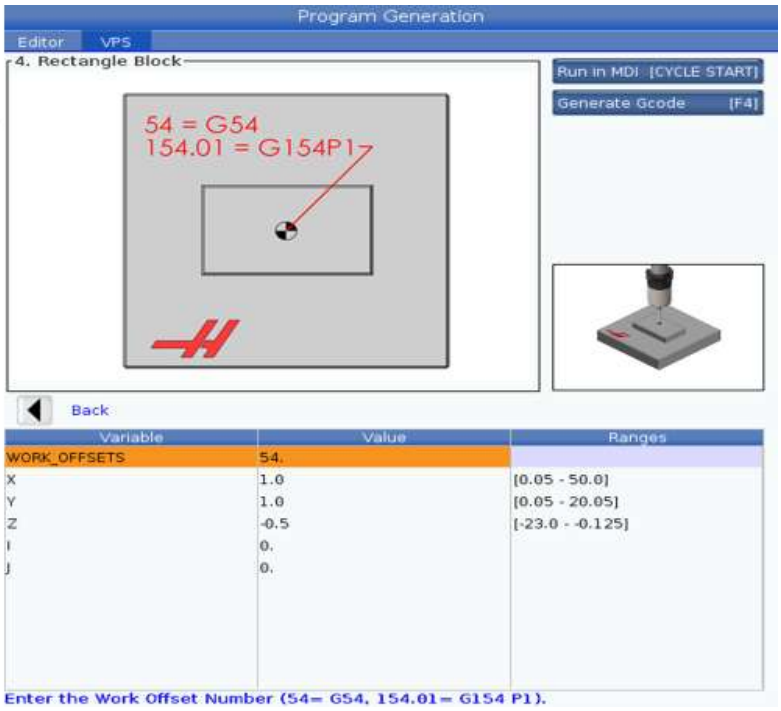
X: The length of the block in the X-direction

Y: The length of the block in the Y-direction

Z: The distance the probe needs to go for the largest diameter of the ruby to hit

I: The distance you want the zero to offset in the X-direction in reference to the center an extruded rectangle

J: The distance you want the zero to offset in the Y-direction in reference to the center an extruded rectangle



Web X Axis is used to find the center of an extruded rectangle in the X-direction

Before beginning, the probe should be positioned in the approximate center of X with a known of clearance above the part

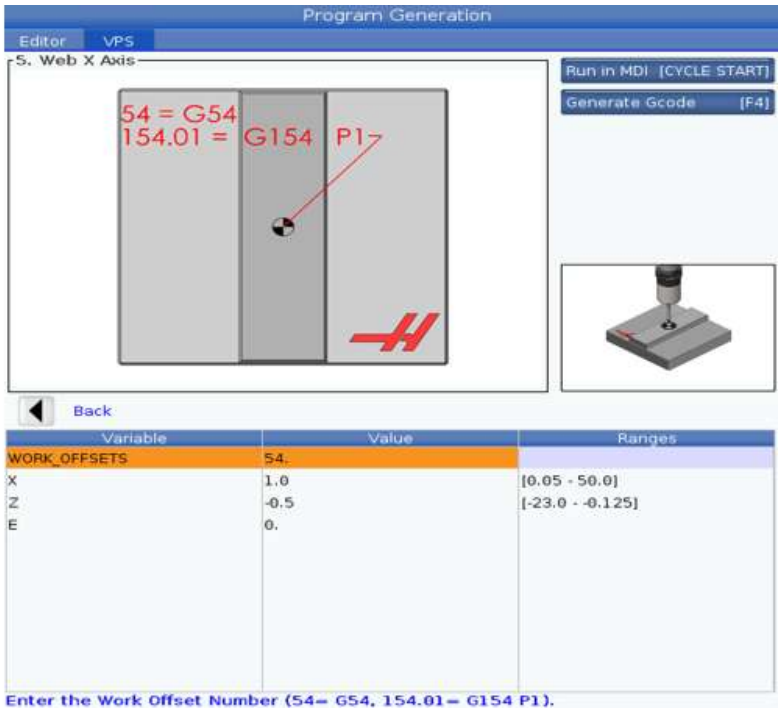
Once selected you will have to input:

WORK_OFFSETS: The work offset you want to work in

X: The length of the feature in the X-direction

Z: The distance the probe needs to go for the entire diameter of the ruby to hit

E: The distance you want the zero to offset in the X-direction in reference to the center an extruded rectangle



Pocket X Axis is used to find the center of X in a rectangular pocket

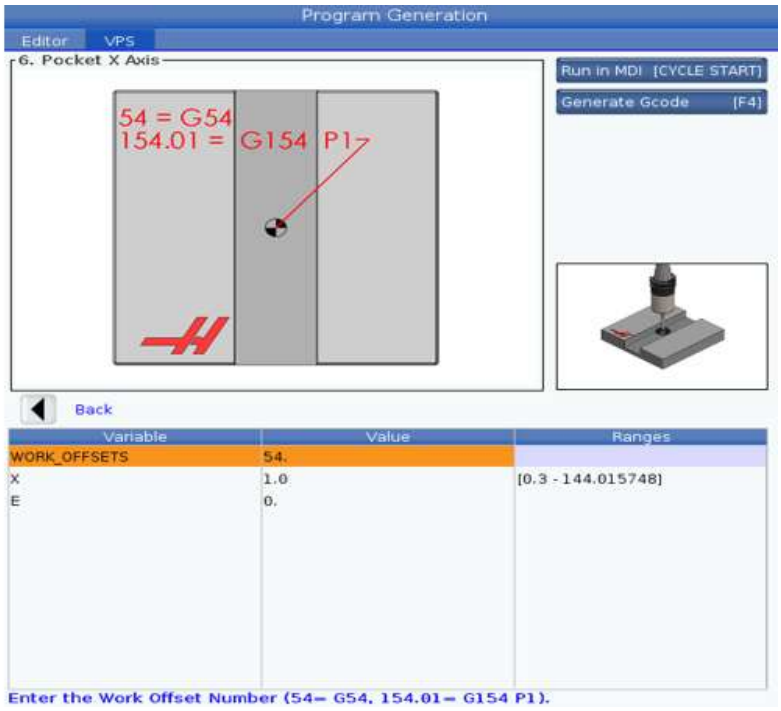
Before you begin, the probe should be positioned approximately in the center of X and low enough for the ruby's entire diameter to hit

Once selected you will have to input:

WORK_OFFSETS: The work offset you want to work in

X: The length of the feature in the X-direction

E: The distance you want the zero to offset in the X-direction in reference to the center an extruded rectangle



Web Y Axis is used to find the center of Y on an extruded rectangle

Before you begin, the probe should be positioned approximately in the center of Y and a known distance above the part

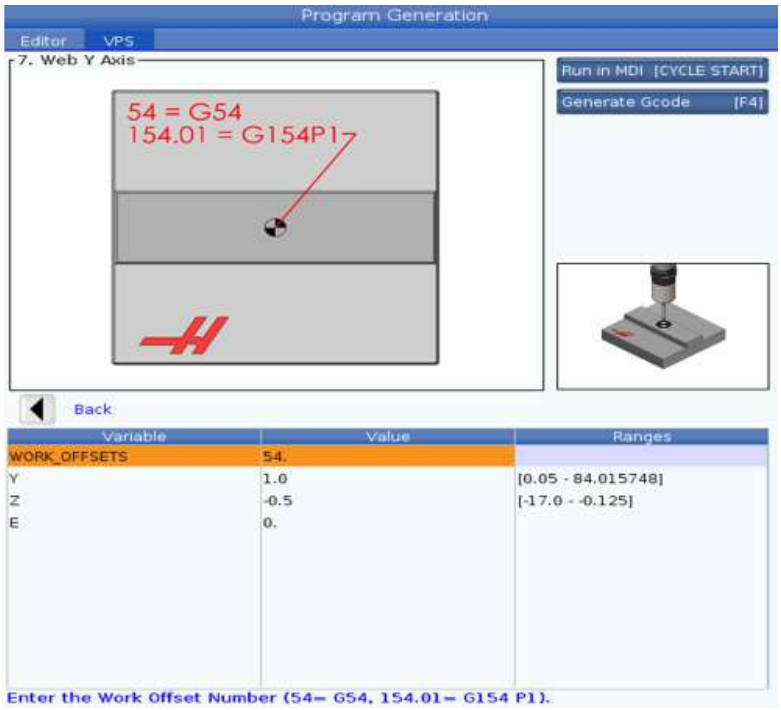
Once selected you will have to input:

WORK_OFFSETS: The work offset you want to work in

Y: The length of the feature in the Y-direction

Z: The distance the probe needs to go for the entire diameter of the ruby to hit

E: The distance you want the zero to offset in the Y-direction in reference to the center an extruded rectangle



Pocket Y Axis is used to find the center of Y in a rectangular pocket

Before you begin, the probe should be positioned approximately in the center of Y and low enough for the ruby's entire diameter to hit

Once selected you will have to input:

WORK_OFFSETS: The work offset you want to work in

Y: The length of the feature in the Y-direction

E: The distance you want the zero to offset in the Y-direction in reference to the center of the rectangular pocket

Outer Corner is used to find the corner between the X and Y Axis

Before beginning, the probe should be positioned a known height above the corner being probed

Once selected you will have to input:

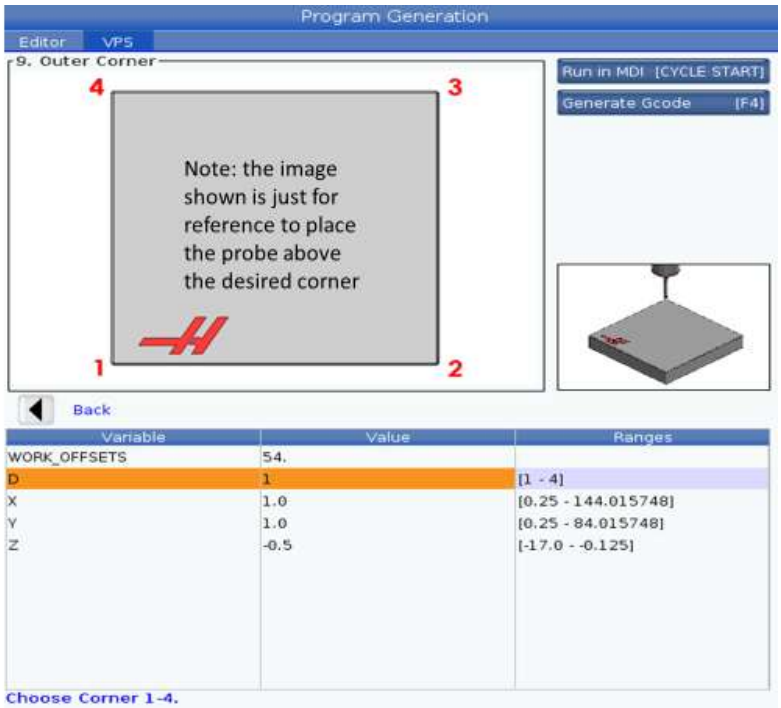
WORK_OFFSETS: The work offset you want to work in

D: The corner you are trying to measure (as shown)

X: The distance you need to travel in the X direction to hit a flat surface

Y: The distance you need to travel in the Y direction to hit a flat surface

Z: The distance you need to go down for the ruby's largest diameter to hit



Inside Corner is used to find the corner between the X and Y Axis

Before beginning, the probe should be positioned a known distance above the corner being probed

Once selected you will have to input:

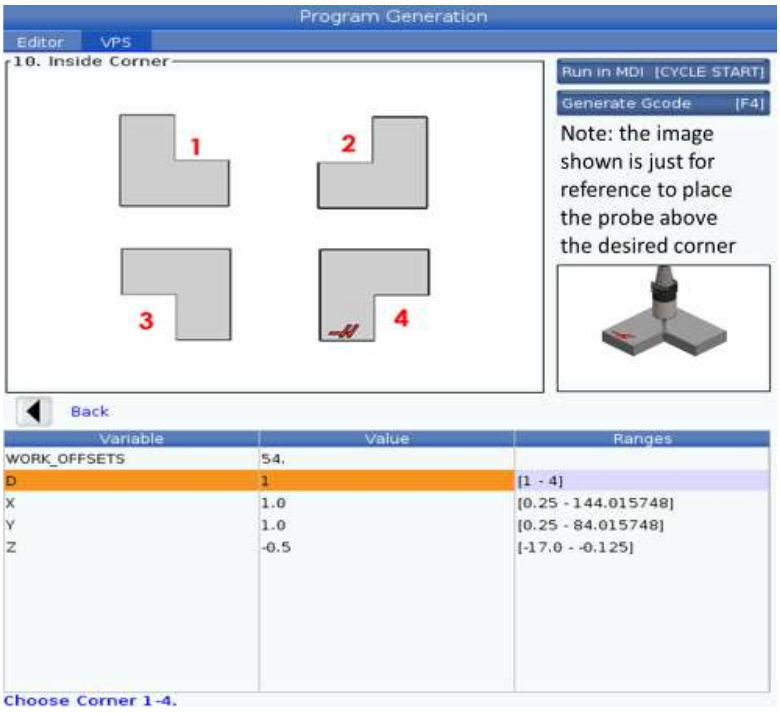
WORK_OFFSETS: The work offset you want to work in

D: The corner you are trying to measure (as shown)

X: The distance you need to travel in the X direction to hit a flat surface

Y: The distance you need to travel in the Y direction to hit a flat surface

Z: The distance you need to go down for the ruby's largest diameter to hit



Single Surface is used to touch off on one surface at a time. It can be used for the X, Y or Z axis

Before you begin, position the probe a known distance away from the surface you want to probe

Once select you will have to input:

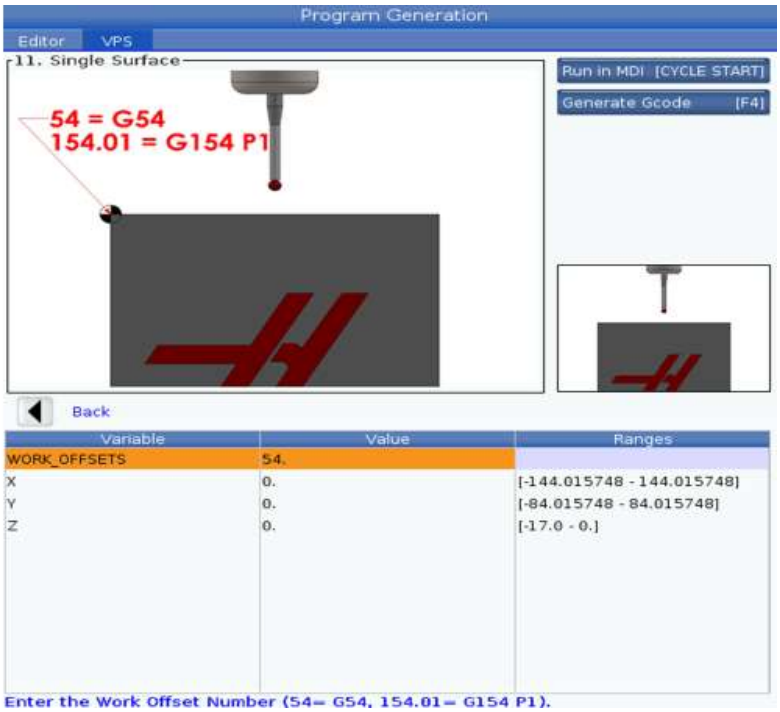
WORK_OFFSETS: The work offset you want to work in

And the axis the surface is parallel to:

X: The distance to the surface

Y: The distance to the surface

Z: The distance to the surface



Vice Corner is used to find the top corner of part

Before beginning, position the probe a known distance over the corner that you want to probe

Once selected you will have to input:

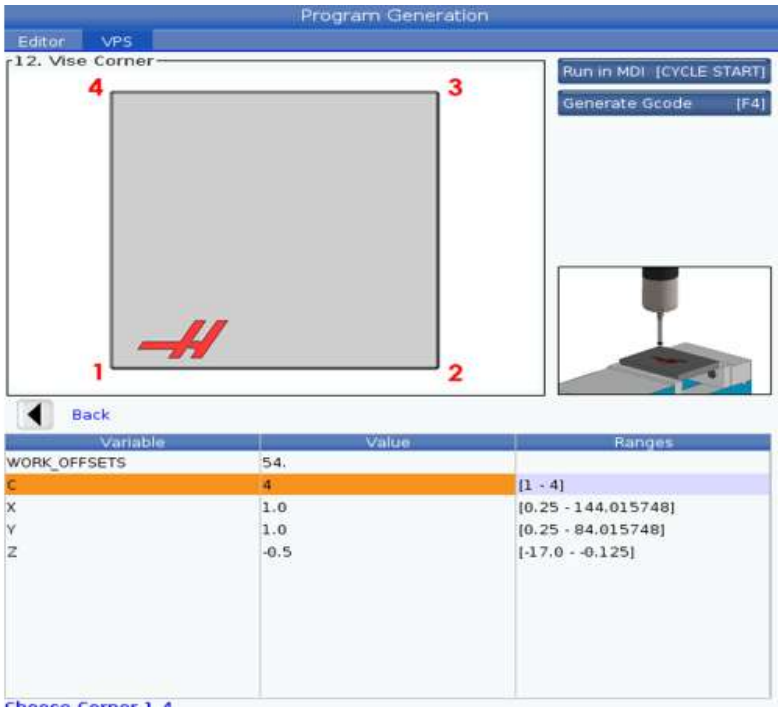
WORK_OFFSETS: The work offset you want to work in

C: The position of the corner you want to probe (as shown)

X: The distance needed to touch a flat surface in the X-direction

Y: The distance needed to touch a flat surface in the Y direction

Z: The distance need to travel to ensure the ruby touches at its max diameter



Angle Measure Probing

Angle Corner Measure is used to measure the angle between to entities in reference to X+ which can be shown with the Macro variables highlighted

Before beginning, position the probe in the corner between the 2 angles. Make sure the entire diameter of the ruby will hit when running

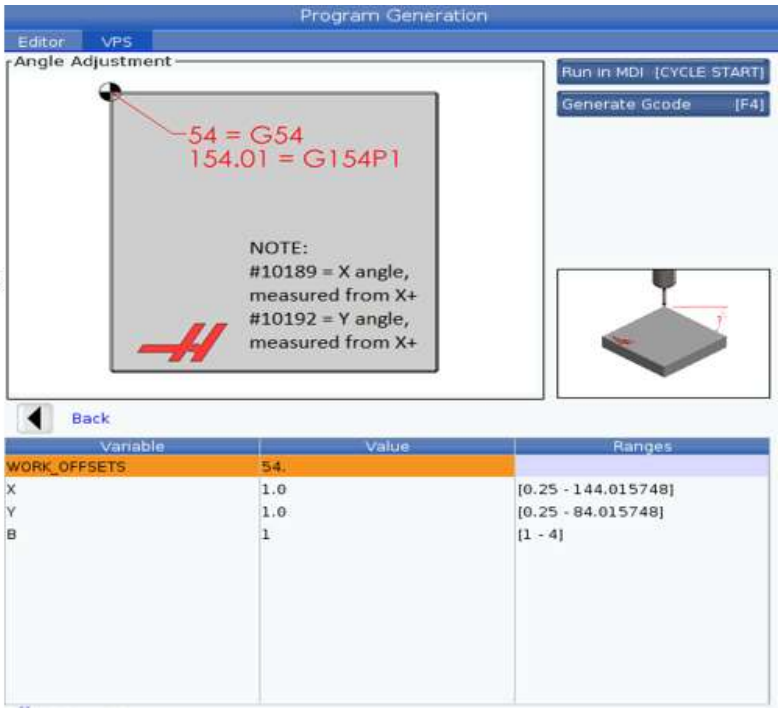
Once selected you will have to input:

WORK_OFFSETS: The work offset you want to work in

X: The total amount of distance you want to travel in the X direction

Y: The total amount of distance you want to travel in the Y direction

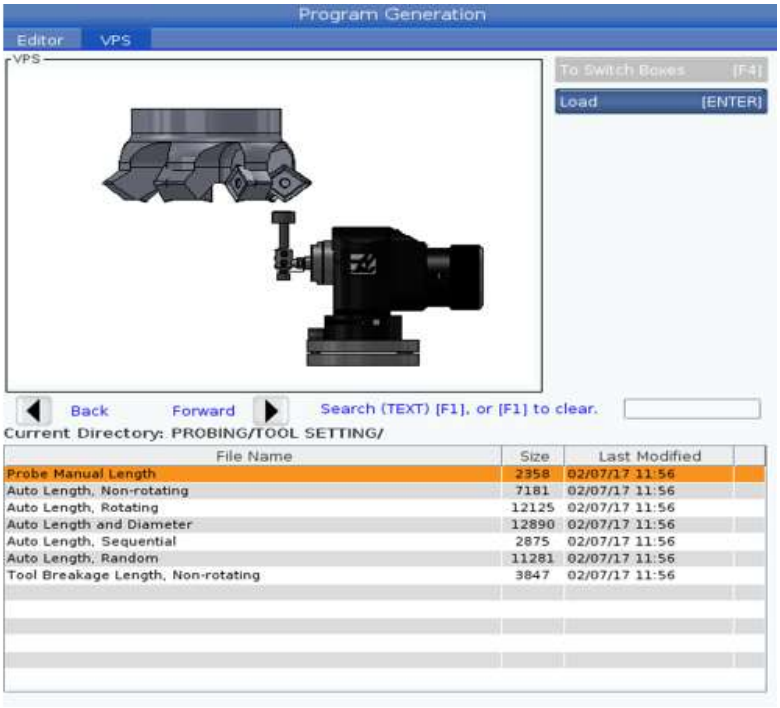
B: Allows you to choose where the corner of the angle is located



[Setting Tool Offsets - Video]

[Tool Offsets Explained - Video]

Setting Tool Offsets



If you return to VPS, curser over under the probing section again you then can select "TOOL SETTING"

Once "TOOL SETTING" is highlighted curser to the right

Here you will be given a variety of options for measuring and setting your tool length and diameter

Probe Manual length allows you to measure the tool length with the OTS manually

In order to do this you must manually bring the tool to the OTS then position the tool about 0.4" above the stylus

Set the tool number you want to indicate

The program will bring the tool down to the stylus a lightly touch it

Auto Length. Non-rotating is used for finding a tool's length when one edge is being measured

Once selected you will have to input:

T: The tool number of the tool you would like to probe

T_T: The type of tool from the ones listed

L: The approximate gauge length of the tool

D: The diameter of the tool

Auto Length. Rotating is used to find the length of a tool and find the lowest point on a tool that has multiple edges

Once selected you will have to input:

T: The tool number of the tool you would like to probe

T_T: The type of tool from the ones listed

L: The approximate gauge length of the tool

D: The diameter of the tool

Auto Length and Diameter is used to find the length of the tool and diameter of the tool

Once selected you will have to input:

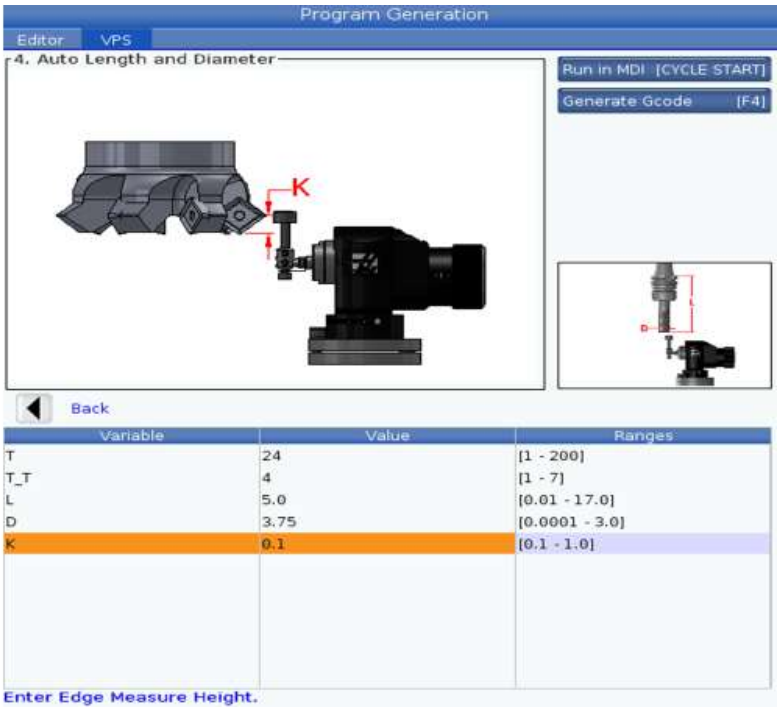
T: The tool number of the tool you would like to probe

T_T: The type of tool from the ones listed

L: The approximate gauge length of the tool

D: the diameter of the tool

K: The distance your cutter needs to go down, in reference to the stylus top, to measure the max diameter

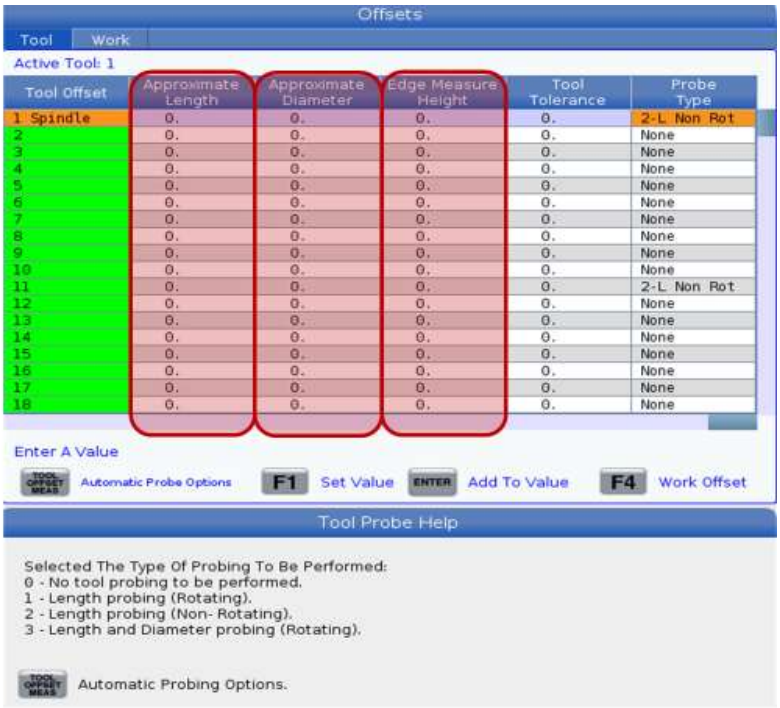


"Probe Manual Length", "Auto Length. Rotating", "Auto Length. Non-rotating" and "Auto Length and Diameter" can be setup from the offsets page.

Filling out the "Approximate Length" will allow you to preform an "Auto Length. Non-Rotating"

Filling out the above and "Approximate Diameter" will allow you to preform an "Auto Length. Rotating"

Filling out the above and the "Edge Measure Height" will allow you to preform an "Auto Length and Diameter"



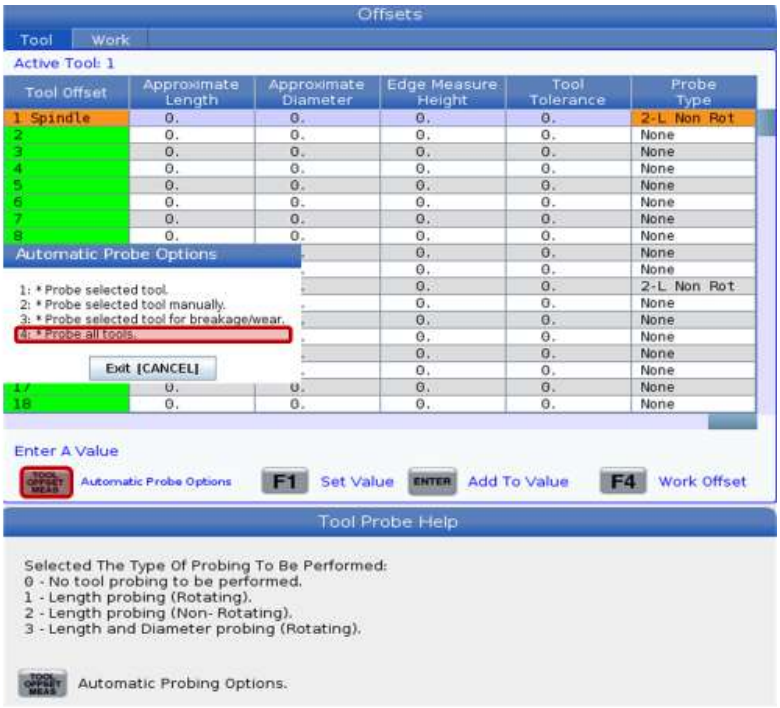
With all tools filled out with a probe type and the required information you can:

Press “Tool Offset Meas”

Then press “4”

Then press “Cycle Start” to begin the probing

This option will “Probe all tools.” in your tool carousel. Any tools with a “Probe Type” left on “None” will be skipped

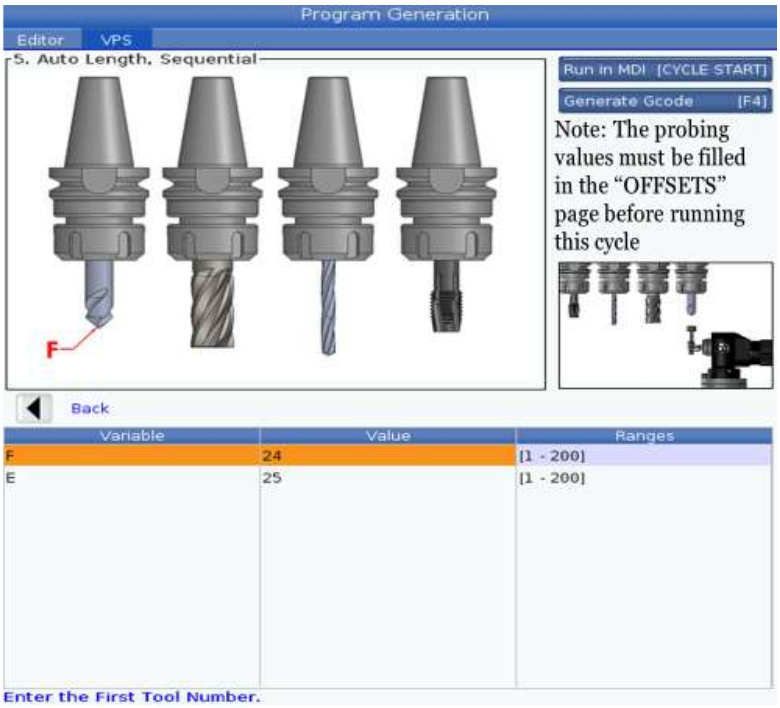


Auto Length. Sequential will allow you to measure multiple tools in a row in the order they are in (cannot be done with shell mills)

Once selected you will have to input:

F: The tool number you’d like to start probing with

E: The tool number you’d like to end probing with



Auto Length. Random will allow you to probe multiple tools of your choice (cannot be done with shell mills)

Once selected you will have to input:

N: The number of tools you would like to measure, 12 tools can be done in one cycle

T1: The tool number of the first tool you want to measure

T2: The tool number of the second tool you want to measure

T3: The tool number of the third tool you want to measure

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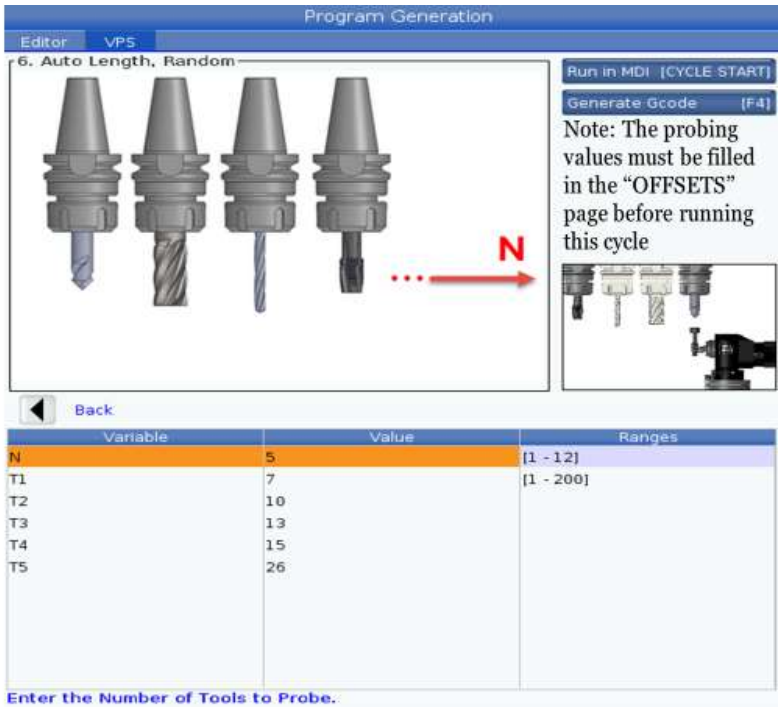


Tool Breakage length. Non-rotating is used to check and see if the tool is broken.

Once selected you will have to input:

T: The tool number of the tool you'd like to probe

H: This is the variance the tool can have

Using the tool breakage is especially useful while running a program where the tool may wear down quickly or break easily

Instead of pressing "CYCLE START" you can press "F4"

This will give you additional options shown:

By pressing "1" it will create the G-code and put it in the clipboard. This will allow you to paste it into a program

By pressing "2", the code will automatically be put into MDI mode where you will be able to hit "Cycle Start" and run it in MDI mode

By pressing "3" you will be given a prompt for a save location and then you will be instructed to give the new program an O number, file name and file comment

This can be used after filling out any of the templates in the VPS mode

By pressing "1" you will be brought to the editor where the G-code will be displayed in the "Clipboard" on the bottom of the screen

EX1) In this example a tool breakage cycle was inserted to the clipboard for tool 3.

1. Scroll down to the line before where you want to input your probing cycle
2. Press "F4" to paste information from clipboard
3. Once it has been pasted you can scroll down to look at the code. Press "Cancel" in order to deselect the text
   - If you press "Enter" or "F4" the text will be pasted again

- Besides the standard VPS templates there are many other options for probing
- Some cycles will reference different macros than the ones written by the standard calibration cycles and require you to do other manual calibration cycles
- Some of the other things you can do with these cycles include:
  - Various Measuring Cycles
  - Vector Measuring Cycles
  - Various setup cycles

[Introduction to Advanced Probing - Video]

[Using Your Probe for Inspection - Video]

Optional Inputs

	Inputting this will allow you to:
Bb	Add an angle tolerance [Ex. B5. = ±5°]
Ee	Allows you to specify the number of a spare tool offset where an adjustment value measured size is stored [Ex. E13 = Causes the experience value to be stored in tool offset 13
Ff	1. Percent feedback when updating a tool offset [A value between 0 to 1 (0%-100%)]. By default the value is set to 100% 2. Input a federate in the protected positioning macro O9810 [Ex. F3. = a federate set at 3in/min]
Hh	The tolerance value of a feature dimension being measured [Ex. H0.010 = ±0.010][Ex. If you have 1.000" with a tolerance of +0.005/-0.000 you would input a nominal of 1.0025" with an H.0025]
Ii	
Jj	See relevant measuring cycles and specific macro calls
Kk	
Mm	This is the true position tolerance of a feature [Ex. M.005 = true position tolerance of .005

Optional Inputs

Qq	This is the probe's over travel distance for when the default values are unsuitable. The probe will travel beyond the expected position when searching for a surface. The default is 0.16" in the Z and 0.394" in the X/Y [Ex. Q0.25 = an overtravel distance of 0.25"]
Rr	This is an incremental dimension that is used for external features such as bosses and webs. This gives radial clearance from the nominal target before a Z move is preformed. [Ex. R.4 = a radial clearance of .4"] Putting a negative will set the clearance in the opposite direction
Ss	The work offset number will be set and will update that work offset S1 to S6 (G54 to G59) S0 (External offset) S110 to S129 (G110 to G129) S154.01 to S154.99 (G154 P4 to G154 P99)
Tt	The tool offset to be updated [Ex. T2 = offset for tool 2 will be updated]
Uu	This is an upper tolerance limit. If this value is exceeded, there will be no tool or work offsets updated and the cycle will alarm out. This will be applied to both size and position when applicable

Optional Inputs

Vv This is a "Null Band" which is a tolerance zone in which no tool offset adjustment will be made [Ex. V.02 = no tool offset change will be made if the tool is ±.02" of the original probed length]

Ww Print Data:

1. = Increment the feature number only
2. = Increment the component number and reset the feature number

All these optional inputs will be noted in []

Macro Variable Outputs

	Single Surface	Web/ Pocket	Bore/ Boss	Internal Corner	External Corner	4th Axis	XY Angle Measure	PCD Bore/ Boss	Stock Allowance	Angle Single Surface	Angle Web/ Pocket	3-Point Bore/Boss	Feature to Feature
	G65P9811	G65P9812	G65P9814	G65P9815	G65P9816	G65P9817/18	G65P9843	G65P9819	G65P9820	G65P9821	G65P9822	G65P9823	G65P9834
#185	X Position	X Position	X Position	X Position	X Position			X Position		X Position From Start	X Position	X Position	X Incremental Distance
#186	Y Position	Y Position	Y Position	Y Position	Y Position			Y Position		Y Position From Start	Y Position	Y Position	Y Incremental Distance
#187	Z position							PCD					Z Incremental Distance
#188	Size	Size	Size					Size		Size From Start	Size	Size	Minimum Distance
#189				X Surface Angle	X Surface Angle	4th Angle	Angle	Angle					Angle
#190	X Error	X Error	X Error	X Error	X Error			X Error		X Error	X Error	X Error	X Error
#191	Y Error	Y Error	Y Error	Y Error	Y Error			Y Error		Y Error	Y Error	Y Error	Y Error
#192	Z Error			Y Surface Angle	Y Surface Angle			PCD Error					Z Error
#193	Size Error	Size Error	Size Error	Y Angle Error	Y Angle Error	Height Error	Height Error	Size Error		Size Error	Size Error	Size Error	Minimum Distance Error
#194				X Angle Error	X Angle Error	Angle Error	Angle Error	Angle Error	Maximum Value				Angle Error
#195	True Position Error	True Position Error	True Position Error	True Position Error	True Position Error			True Position Error	True Position Error	True Position Error	True Position Error	True Position Error	True Position Error
#196	Metal Condition	Metal Condition	Metal Condition					Metal Condition	Metal Condition	Metal Condition	Metal Condition	Metal Condition	Metal Condition
#197	Direction Indicator							Hole Number		Direction Indicator			
#198	Out of tolerance flag (1 to 7)												
#199	Probe error flag (0 to 2)												

Macro Variables Use

#0 to #33	For general use
#100 to #119	Reserved for HAAS use
#120 to #139	Available for user
#140 to #155	Purchased Devices (Probe, Bar Feeder, Pallet Changer, etc.)
#156 to #199	Probe use
#500 to #519	Reserved for HAAS use
#520 to #539	Available to user
#540 to #555	Purchased Devices (Probe, Bar Feeder, Pallet Changer, etc.
#556 to #599	Probe use

Calibration Cycles

- Macro O9801 | This is used to establish the probe length in its tool shank
- Macro O9802 | This is used to establish the stylus off-center values
- Macro O9803 | This is used to establish the stylus ball radius values. This is suitable for all measuring cycles except O9821, O9822, and O9823
- Macro O9804 | This is used to establish the vector stylus ball radius values. This is suitable for all measuring cycles including O9821, O9822, and O9823

Macro O9801 → Probe Length Calibration

This will establish the length of the probe and will update the length when the cycle is complete

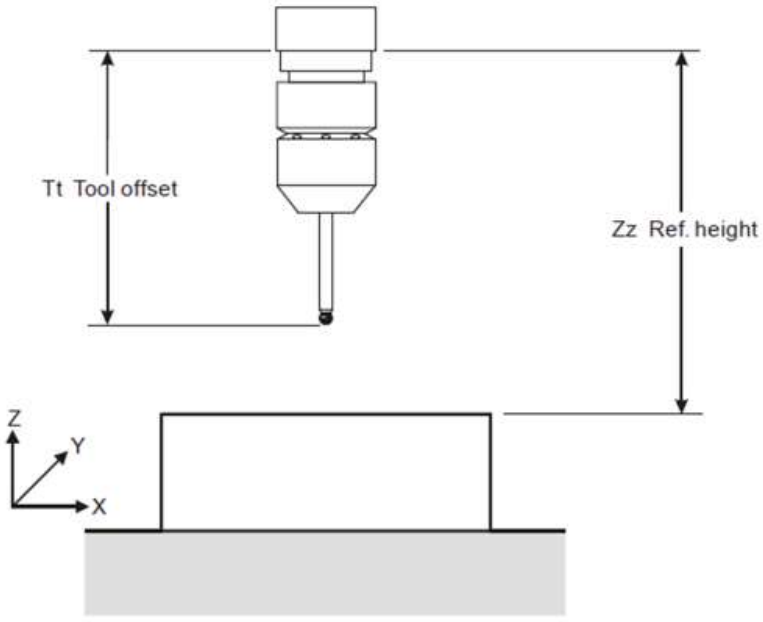
The format for this is:

G65 P9801 Zz. Tt.

Compulsory Inputs:

Zz → Reference surface position

Tt → The active tool offset number



Macro O9802 → Calibrating X and Y offsets

This cycle is to be run on a pre-machined hole with a suitable boring bar with the exact center known. This will also have to be run with spindle orientation on.

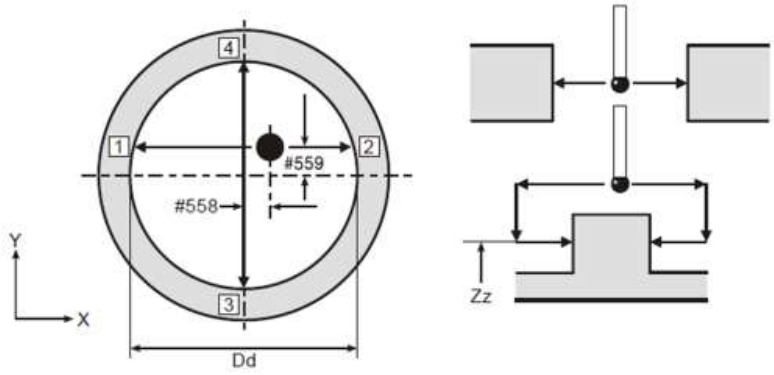
The format for this is:

G65 P9802 Dd. [Zz.]

(Note: The Zz is only required if you're probing a cylindrical boss. This is an absolute positioning move)

Outputs:

#558 (556+2) = X axis stylus offset
#559 (559+3) = Y axis stylus offset



Macro O9803 → Probe Ball Radius Calibration

This will establish the radius of the probe ball by completing 6 moves with spindle orient on. The probe will need to be put into a ring gauge in the approximate center.

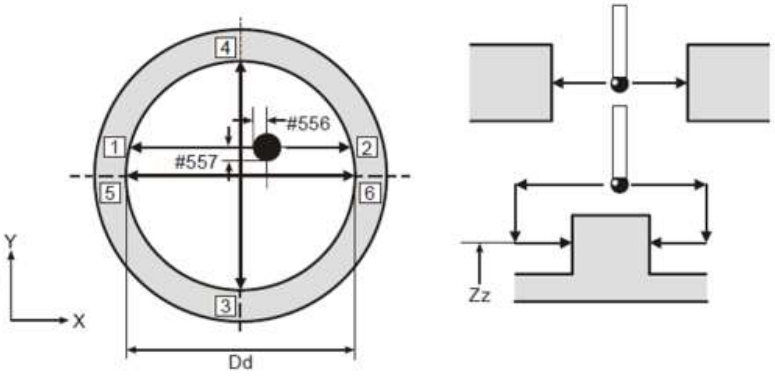
The format for this is:

G65 P9803 Dd. [Zz. Ss.]

(Note: The Zz is only required if you're probing a cylindrical boss. This is an absolute positioning move. Ss is used if after probing you want to set a work offset as well)

Outputs:

#556 (556+0) = X+, X-, stylus ball radius (XRAD)
#557 (556+1) = Y+, X-, stylus ball radius (YRAD)



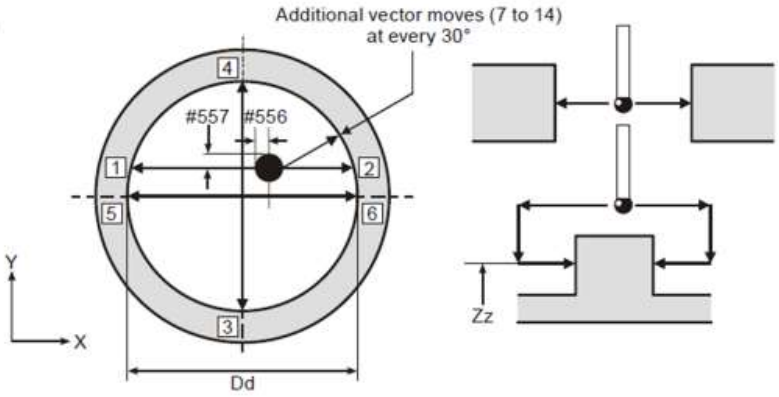
Macro O9804 → Vector Stylus Ball Calibration

This will establish the vector radius of the probe ball by completing 14 moves with spindle orient on. The probe will need to be put into a ring gauge in the approximate center. This will touch of in 30° intervals.

The format for this is:

G65 P9804 Dd. [Zz. Ss.]

Output:
#556 (556+0) = X+, X-, stylus ball radius (XRAD)
#557 (556+1) = Y+, Y-, stylus ball radius (YRAD)
#566 (556+10) = 30° stylus ball radius
#567 (556+11) = 60° stylus ball radius
#568 (556+12) = 120° stylus ball radius
#569 (556+13) = 150° stylus ball radius
#570 (556+14) = 210° stylus ball radius
#571 (556+15) = 240° stylus ball radius
#572 (556+16) = 300° stylus ball radius
#573 (556+17) = 330° stylus ball radius



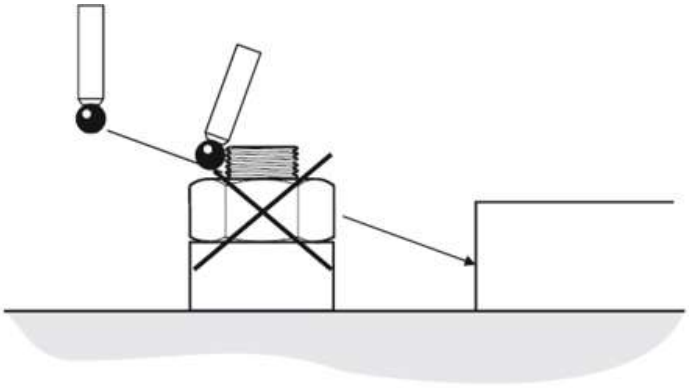
Protected Positioning

When moving the probe around the workpiece to protect the stylus against collision or breakage. When the protected cycle is used the machine will stop in the event of a collision

The format should be something like:

G65 P9810 Xx. Yy. Zz. [Ff. Mm]

- Xx, Yy and Zz → the target position
- Ff → this is a modal feedrate for positional moves
- Mm → Will set a probe trigger flag (no PATH OBSTRUCTED alarm)
  - #198 = 0 (No probe trigger)
  - #198 = 7 (Probe trigger)



Example

G1G54X20.Y50.	
G43H20Z100.	Move to a safe plane.
G65P9832	Spin the probe on (includes M19) or M19 for spindle orientation.
G65P9810Z10.F3000	Protected positioning move.
G65P9811Z0S1	Single surface measure.

Standard Measuring Cycles

There are a few different measuring cycles that can be preformed. These can all be accessed though your VPS/Probing/Work Offsets. This section will display how to manually call up these cycles.

The measurement cycles include:

- Macro O9811 | X Y Z Single Surface Measurement
- Macro O9812 | Web/Pocket Measurement
- Macro O9814 | Bore/Boss Measurement
- Macro O9815 | Finding an Internal Corner
- Macro O9816 | Finding an External Corner

Macro O9811 → X Y Z Single Surface

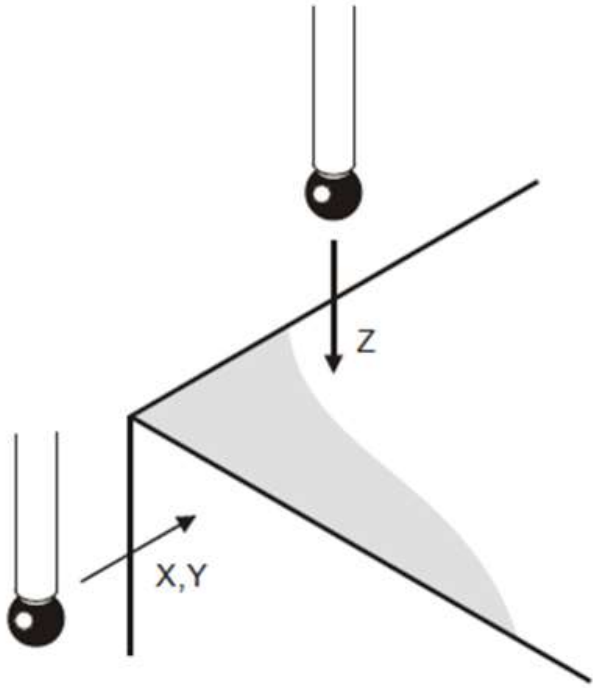
This cycle is used to establish the size and position of a surface. The probe should position adjacent to the surface to the desired probing surface. This has 2 possibilities:

1. The surface can be treated as a size and update the tool offset in along with Tt and Hh

2. The surface can be treated as a reference surface position, for setting and adjusting work offsets using Ss and Mm inputs

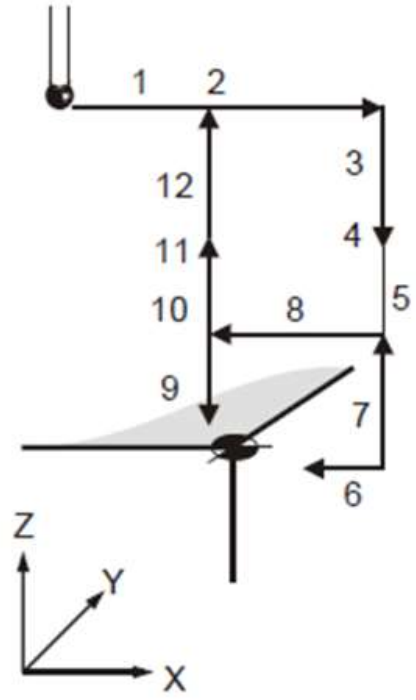
The format for this is:

G65 P9811 Xx. or Yy. or Zz. [Ee. Ff. Hh. Mm. Qq. Ss. Tt Uu Vv Ww]



Ex. Showing X and Z Single Surface Measurement

1. T20 M6	1. Select Probe
2. G54 X1.5 Y0.75	2. Start position
3. G43 H20	3. Active offset
4. G01 Z4. F50.	4. Go to Z position
5. G65 P9832	5. Turn off the probe and M19
6. G65 P9810 Z-0.375	6. Protected positioning move to start position
7. G65 P9811 X-2. Y0.375	7. Single Surface Measurement
8. G65 P9810 Z0.375	8. Protected position move
9. G65 P9810 X-2.375	9. Protected position move
10. G65 P9811 Z0 Y0.375	10. Single Surface Measure
11. G65 P9810 Z4.	11. Protected position move
12. G65 P9833	12. Turn off the probe
13. G28 Z0.	13. Reference return



Macro O9812 → Web/Pocket Measurement

This cycle will measure a web or a pocket feature. To do this you have to position the probe over the expected center line of the feature you would like to probe.

The format for these are:

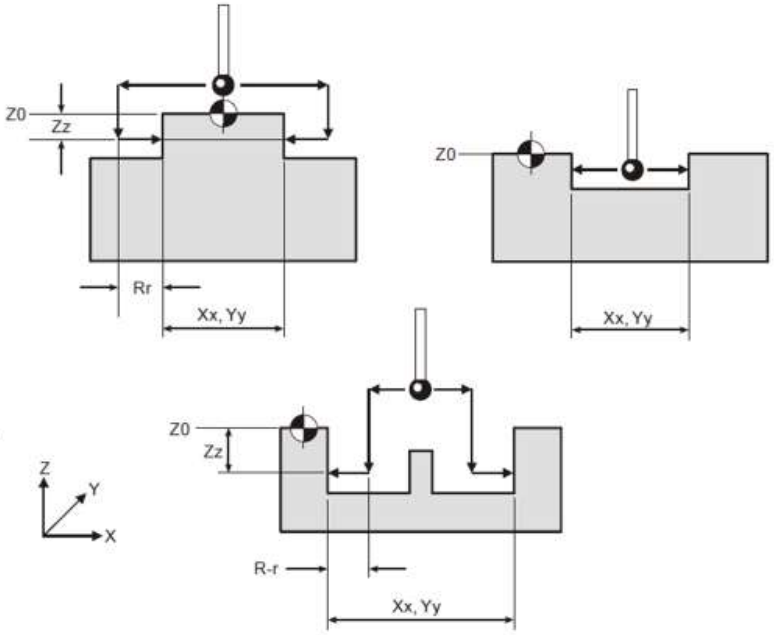
G65 P9812 Xx. [Ee. Ff. Hh. Mm. Qq. Rr. Ss. Tt. Uu. Vv. Ww.]

G65 P9812 Yy. [Ee. Ff. Hh. Mm. Qq. Rr. Ss. Tt. Uu. Vv. Ww.]

G65 P9812 Xx. Zz. [Ee. Ff. Hh. Mm. Qq. Rr. Ss. Tt. Uu. Vv. Ww.]

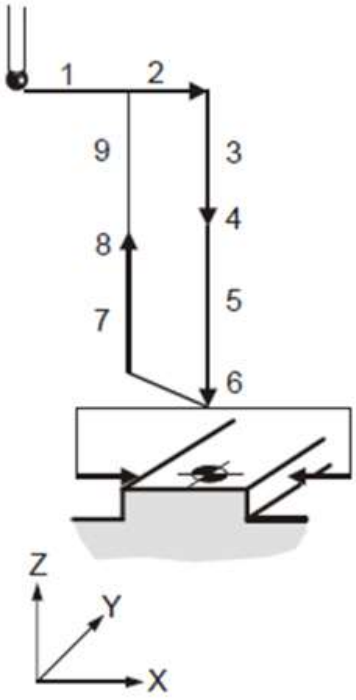
G65 P9812 Yy. Zz. [Ee. Ff. Hh. Mm. Qq. Rr. Ss. Tt. Uu. Vv. Ww.]

(Note: The Zz is only required if you're probing a web feature, otherwise a pocket is assumed)



Ex. Web Measurement

1. T20 M6	1. Select probe
2. G54 X0 Y0	2. Start position
3. G43 H20	3. Activate offset 20
4. G01 Z4. F50.	4. Go 4." above part
5. G65 P9832	5. Turn on probe (includes M19)
6. G65 P9810 Z0.375 F120.	6. Protected positioning move
7. G65 P9812 X2. Z-0.375	7. Measure a 2." wide web
8. G65 P9810 Z4.	8. Protected positioning move
9. G65 P9833	9. Turn probe off
10. G28 Z0.	10. Reference return



Macro O9814 → Bore/Boss Measurement

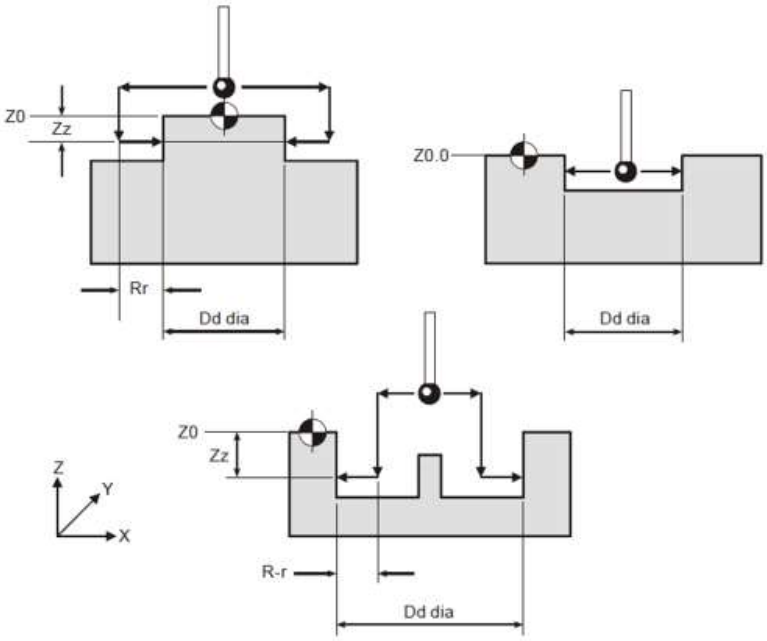
This cycle will measure a Bore or a Boss. To do this you have to position the probe over the expected center of the feature you would like to probe.

The format for these are:

G65 P9814 Dd. [Ee. Ff. Hh. Mm. Qq. Rr. Ss. Tt. Uu. Vv. Ww.]

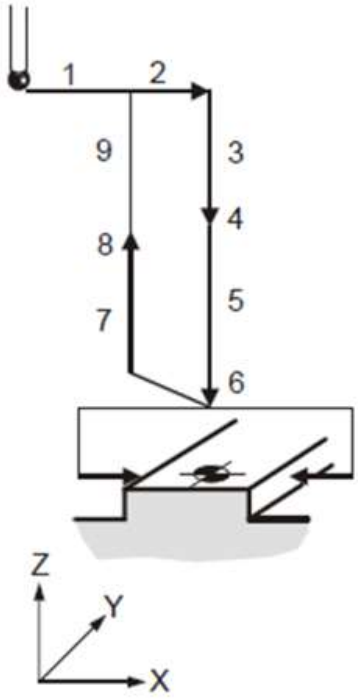
G65 P9814 Dd. Zz. [Ee. Ff. Hh. Mm. Qq. Rr. Ss. Tt. Uu. Vv. Ww.]

(Note: The Zz is only required if you're probing a boss feature, otherwise a bore is assumed)



Ex. Web Measurement

1. T20 M6	1. Select probe
2. G54 X4. Y4.	2. Start position
3. G43 H20	3. Active offset 20
4. G01 Z4. F50.	4. Go to 4."
5. G65 P9832	5. Turn on probe (includes M19)
6. G65 P9810 Z-0.375 F120.	6. Protected positioning move
7. G65 P9814 D.1875 S1	7. Measure a 0.1875" diameter bore
8. G65 P9810 Z4.	8. Protected positioning move
9. G65 P9833	9. Turn probe off
10. G28 Z0.	10. Reference return

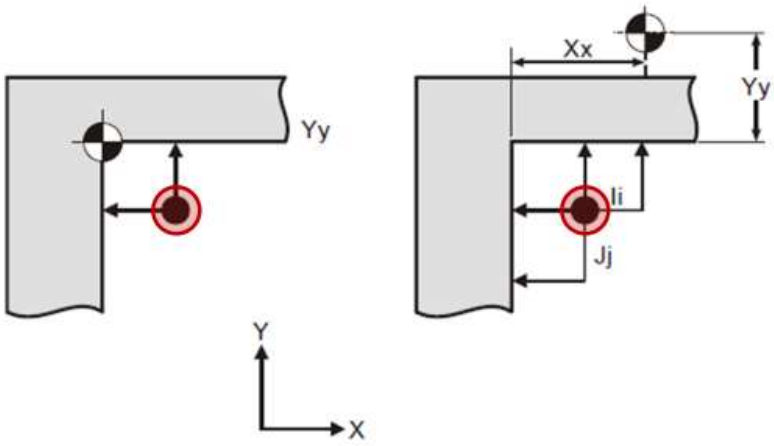


Macro O9815 → Finding an Internal Corner

This cycle will allow you to establish the corner of a feature (it does not need to be a 90°). The probe must be positioned as shown by the black dot. It also must be positioned low enough to that the largest diameter will touch. The probe will measure the Y then measure the X axis surface.

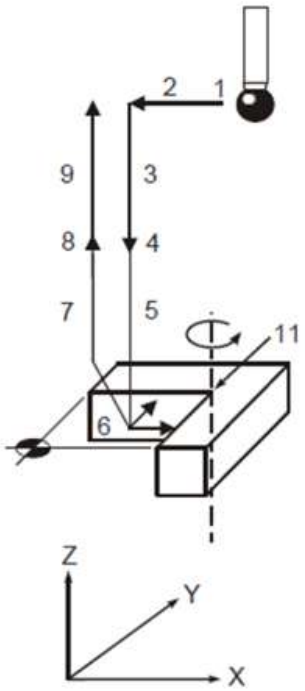
The format for this is:

G65 P9815 Xx. Yy. [Bb. Ii. Jj. Mm. Qq. Ss. Uu. Ww.]



Ex. Finding an Internal Corner

1. T20 M6	1. Select probe
2. G54 X0.375 Y0.375	2. Start position
3. G43 H20	3. Activate offset 20
4. G01 Z4. F50.	4. Go to 4."
5. G65 P9832 F120.	5. Turn on probe (includes M19)
6. G65 P9810 Z-0.1875	6. Protected positioning move
7. G65 P9815 X0.75 Y0.75 I0.75 J0.75	7. Corner find
8. G65 P9810 Z3.9370	8. Protected positioning move
9. G65 P9833	9. Turn off probe
10. G28 Z3.9370	10. Reference return
11. G17	11. Select plane
12. G68 X#185 Y#186 R#189	12. Set rotational position and angle
13. Continue Machine Part…	13. Run through part program
14. G69	14. Cancel rotation mode

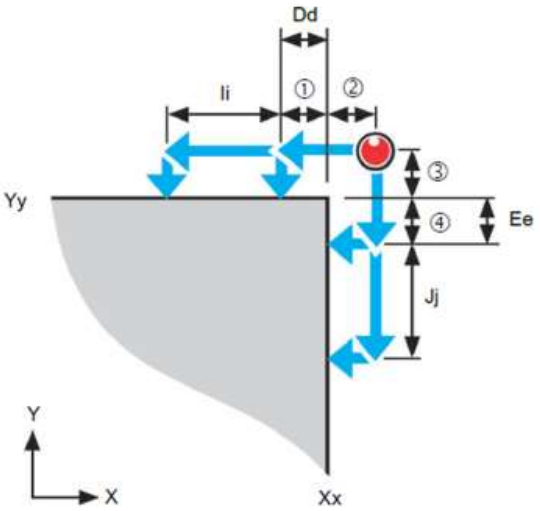


Macro O9816 → Finding an External Corner

This cycle will allow you to establish the corner of a feature (it does not need to be a 90°). The probe must be positioned next the corner that you would like to probe. It also must be positioned low enough to that the largest diameter will touch. If you position the probe above the corner, you will need to include a "Zz" value. The probe will measure the Y then measure the X axis surface.

The format for this is:

G65 P9816 Xx. Yy. [Bb. Ii. Jj. Mm. Qq. Ss. Uu. Ww. Zz.]



NOTE:
The start point establishes the distance to the first measuring position.

Default moves:
① and ② are equal.
③ and ④ are equal.

Ex. Finding an External Corner

1. T20 M6	1. Select the Probe
2. G54 X0.375 Y0.375	2. Start position
3. G43 H20	3. Activate offset 20
4. G65 P9832	4. Probe start up program (This includes M19)
5. G65 P9810 Z-0.1875 F120.	5. Protected positioning move
6. G65 P9816 X0. Y0. I0.375 J0.375	6. Corner find
7. G65 P9810 Z2.	7. Protected positioning move
8. G65 P9833	8. Probe finish program
9. G91 G28 Z0.	9. Reference return
10. G17	10. Select the plane
11. G68 X#135 Y#136 R#139	11. Set the corner position and angle
12. Continue Machining...	12. ...
13. G69	13. Cancel the co-ordinate rotation mode

Vector Measuring Cycles

There are a few different measuring cycles that can be preformed. These cycles are for vector measuring. To use these cycles the probe must be calibrated using either O9801 K4. or O9801 K5. cycle.

The measurement cycles include:

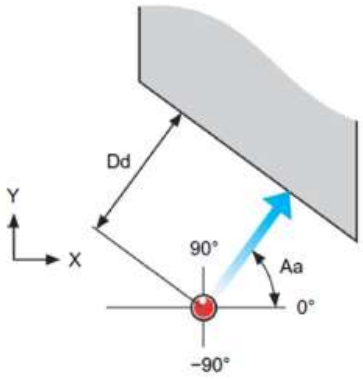
- Macro O9821 | Angled surface measurement using the A and D inputs
- Macro O9821 | Angled surface measurement using the X, Y, Z inputs
- Macro O9822 | Angled web or pocket measurement
- Macro O9823 | 3-point bore or boss measurement

Macro O9821 → Angled Surface Measurement Using the A and D Inputs

This cycle measures a surface feature using one vectored measuring move along the XY axis. With the probe active and the probe offset active, position the probe at the expected reference point of the feature. Make sure the probe is positioned low enough for the largest diameter of the probe to hit.

The format for this is:

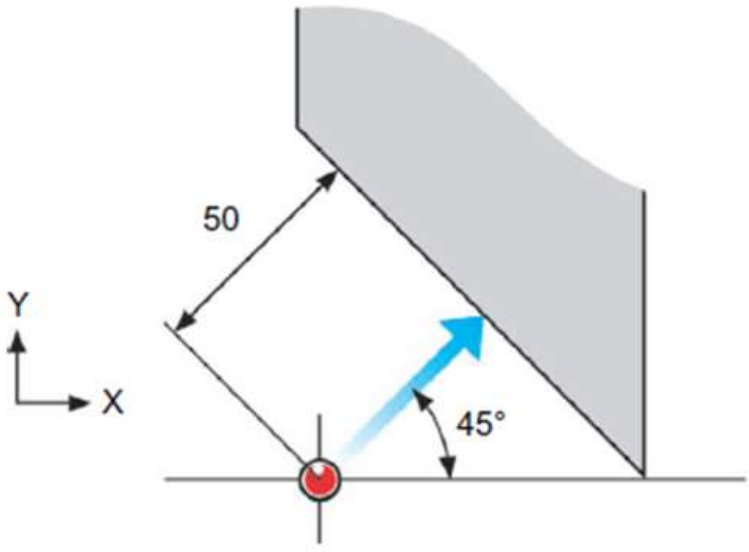
G65 P9821 Aa. Dd. [Ee. Ff. Hh. Mm. Qq. Ss. Tt. Uu. Vv. Ww.]



NOTE:
Angles are in the range ±180°.
Positive (+) angle: Counterclockwise direction.
Negative (–) angle: Clockwise direction.

Ex. Angled Surface Measurement

1. T20 M6	1. Select Probe
2. G54 X40. Y20.	2. Start Position
3. G43 H20	3. Activate probe offset
4. G65 P9832	4. Probe start up program
5. G65 P9810 Z-8. F120.	5. Protected positioning
6. G65 P9821 A453 D50. T10.	6. Single surface measurement
7. G65 P9810 Z100	7. Protected positioning
8. G65 P9833	8. Probe finish
9. G91 G28 Z0.	9. Reference return



Macro O9822 → Angled Web or Pocket Measurement

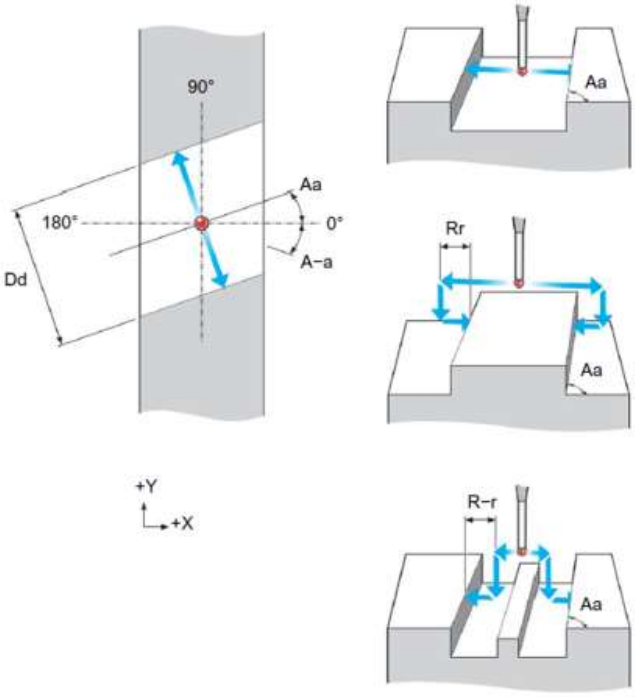
This cycle will measure a web or pocket feature using two vectored measuring moves along the XY axis.

The format for this is:

G65 P9822 Aa. Dd. [Ee. Ff. Hh. Mm. Qq. Rr. Ss. Tt. Uu. Vv. Ww.]

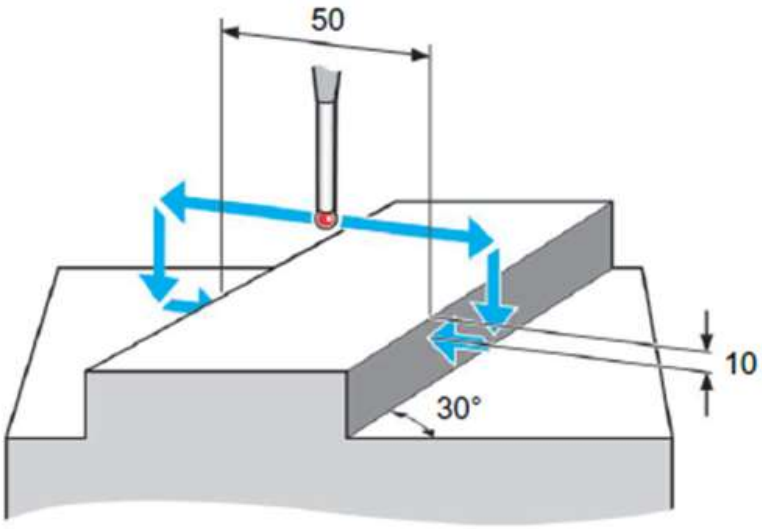
Or

G65 P9822 Aa. Dd. Zz. [Ee. Ff. Hh. Mm. Qq. Rr. Ss. Tt. Uu. Vv. Ww.]



Ex. Measuring an Angled Web

1. T20 M6	1. Select Probe
2. G54 X0. Y0.	2. Start Position
3. G43 H20	3. Activate probe offset
4. G65 P9832	4. Probe start
5. G65 P9810 Z10. F3000.	5. Protected positioning move
6. G65 P9822 A30. D50. Z-10. S2.	6. Measure a 50mm wide web at 30°
7. G65 P9810 Z100.	7. Protected positioning move
8. G65 P9833	8. Probe finish
9. G91 G28 Z0.	9. Reference return



Macro O9823 → 3-Point Bore or Boss Measurement

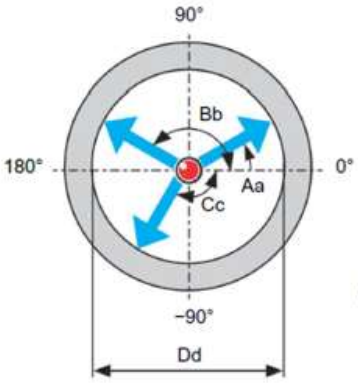
This cycle will measure a bore or a boss using 3-point vector measuring moves along the XY axis. The probe must be positioned over the center of the bore/boss.

The format for this is:

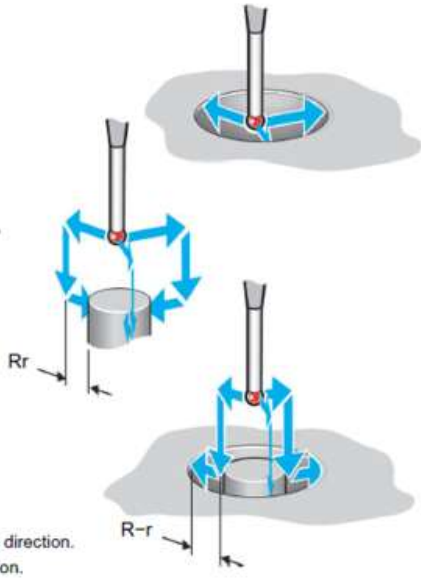
G65 P9823 Aa. Bb. Cc. Dd. [Ee. Ff. Hh. Mm. Qq. Rr. Ss. Tt. Uu.]

Or

G65 P9823 Aa. Bb. Cc. Dd. Zz. [Ee. Ff. Hh. Mm. Qq. Rr. Ss. Tt. Uu.]



NOTE:
Angles are in the range ±180°.
Positive (+) angle: Counterclockwise direction.
Negative (–) angle: Clockwise direction.



Ex. 3-Point Bore Measurement

1. T20 M6	1. Select the Probe
2. G54 X4. Y4.	2. Start position
3. G43 H20	3. Activate probe offset
4. G65 P9832	4. Probe start up program (This includes M19)
5. G65 P9810 Z-0.375 F120.	5. Protected positioning move
6. G65 P9822 D1.1875 A45.005 B150. C-135.005 S2.	6. Measuring a 1.1875" diameter bore
7. G65 P9810 Z4.	7. Protected positioning move
8. G65 P9833	8. Probe finish
9. G91 G28 Z0.	9. Reference return

Note: Probing the center of a boss would follow the same code format but include a "Zz" call on line 5.

Additional Cycles

There are some additional probing cycles available to you. These cycles cannot be described under the previous sections

The measurement cycles include:

• Macro O9817	4th axis X measurement
• Macro O9818	4th axis Y measurement
• Macro O9819	Bore/Boss on PCD measurement
• Macro O9820	Stock allowance
• Macro O9834	Determining feature-to-feature data in the XY plane Determining feature-to-feature data in the Z plane
• Macro O9843	Angle measurement in the X or Y plane

Macro O9817 → 4th Axis X Measurement

This cycle is used to find the slope of a surface between two points. The 4th axis can then be rotated to compensate for the surface error.

Position the rotary axis to the expected angular position. The cycle will find the error for surface position, then adjust the axis work offset or check the tolerance

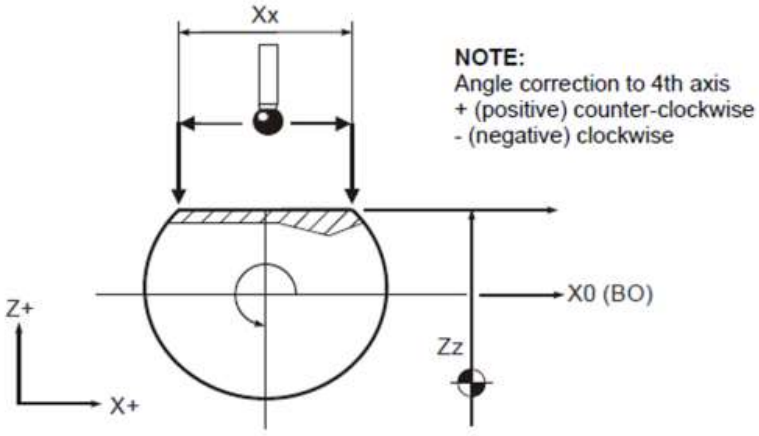
The format for this is:

G65 P9817 Xx. Zz. [Qq. Bb. Ss. Ww.]

Compulsory Inputs:

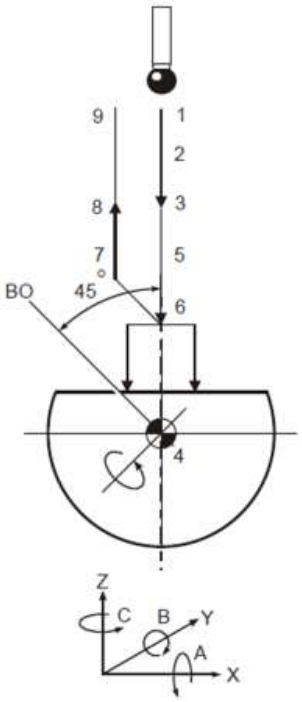
Xx → The X axis distance between Z1 and Z2 measurement positions

Zz → The Z axis expected surface position



Ex. 4th Axis X Measurement

1. T20 M6	1. Select Probe
2. G43 H20	2. Move 7.875"
3. G01 Z7.875 F50.	3. Activate tool offset,
4. G65 P9832	4. Turn on probe
5. G0 B45.	5. Position 4th axis to 45°
6. G65 P9810 X0. Y0. Z0.75 F120.	6. Position 0.75" above surface
7. G65 P9817 X2. Z0.375 B5.	7. Measure at 2.", update G54 and set a 5° tolerance
8. G65 P9810 Z7.875	8. Protected positioning move
9. G65 P9833	9. Turn off probe
10. G28 Z7.875	10. Reference return



Macro O9817 → 4th Axis Y Measurement

This cycle is used to find the slope of a surface between two points. The 4th axis can then be rotated to compensate for the surface error.

Position the rotary axis to the expected angular position. The cycle will find the error for surface position, then adjust the axis work offset or check the tolerance

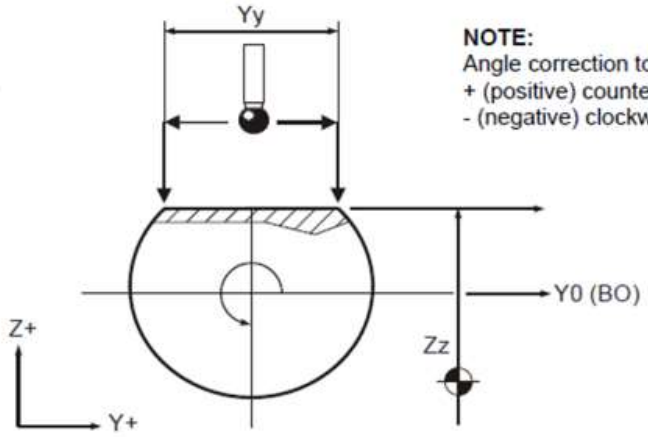
The format for this is:

G65 P9817 Yy. Zz. [Qq. Bb. Ss. Ww.]

Compulsory Inputs:

Yy → The Y axis distance between Z1 and Z2 measurement positions

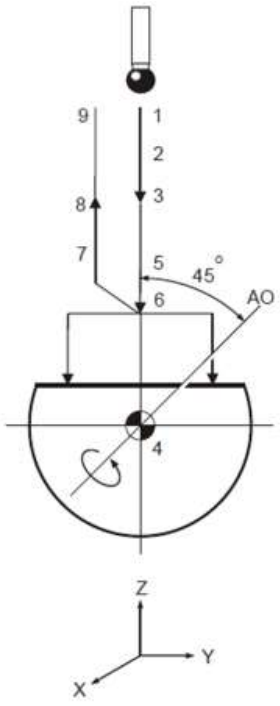
Zz → The Z axis expected surface position



NOTE:
Angle correction to 4th axis
+ (positive) counter-clockwise
- (negative) clockwise

Ex. 4th Axis Y Measurement

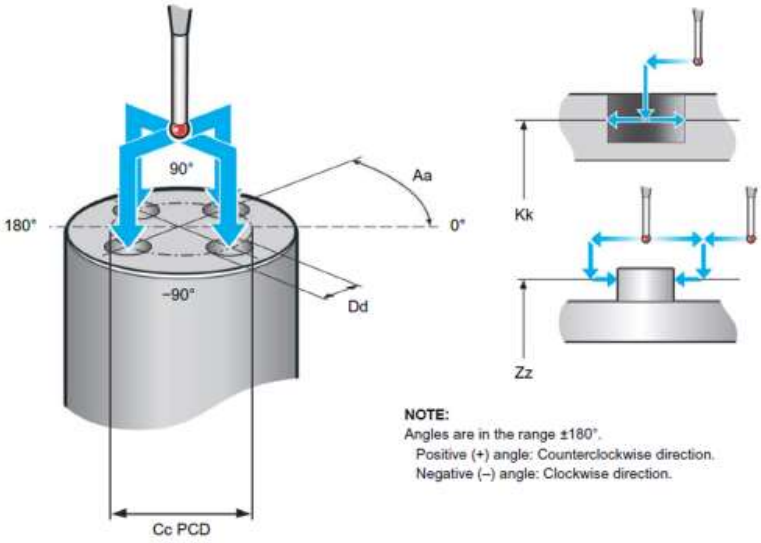
1. T20 M6	1. Select Probe
2. G43 H20	2. Go 7.875"
3. G01 Z7.875 F50.	3. Activate tool offset
4. G65 P9832	4. Turn on probe
5. G0 A45.	5. Position 4th axis to 45°
6. G56 P9810 X0. Y0. Z0.75 F120.	6. Position 0.375" above surface
7. G65 P9818 Y2. Z0.375 S1. B5.	7. Measure 2.", update G54 and set a 5° tolerance
8. G65 P9810 Z7.875	8. Protected position move
9. G65 P9833	9. Turn probe off
10. G28 Z7.875	10. Reference return



Macro O9819 → Bore/Boss on PCD Measurement

This cycle will measure the Pitch Circle Diameter (PCD). Things to note:

1. Position the probe in the center of the PCD, above the component. The probe will then move to each of the features and measure each one.
2. This cycle makes use of the Bore/Boss cycle which is nested 3 levels deep. This prevents this cycle from being nested inside a G-code program
3. If a "probe-open" conditions occurs during any of the moves, a "PATH OBSTRUCTED" alarm occurs. The probe will remain in its alarm position instead of returning to its start position for safety reasons



Macro O9819 → Bore/Boss on PCD Measurement

The Format for this:

Boss = G65 P9819 Cc. Dd. Zz. [Aa. Bb. Hh. Mm. Qq. Rr. Ww.]

Or

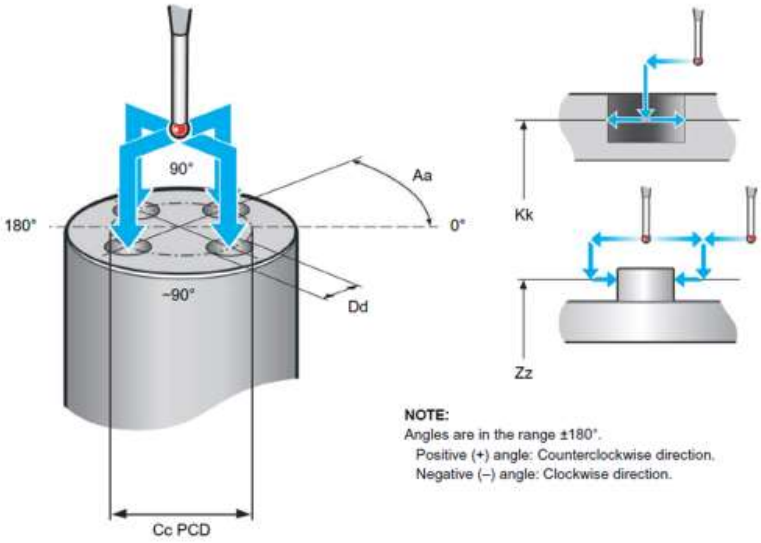
Bore = G65 P9819 Cc. Dd. Kk. [Aa. Bb. Hh. Mm. Qq. Rr. Ww.]

Cc. → PCD, the pitch circle diameter of the feature

Dd. → Diameter of the bore/boss

Kk. → Absolute Z-axis at which the bore is measured

Zz. → Absolute Z-axis at which the boss is measured

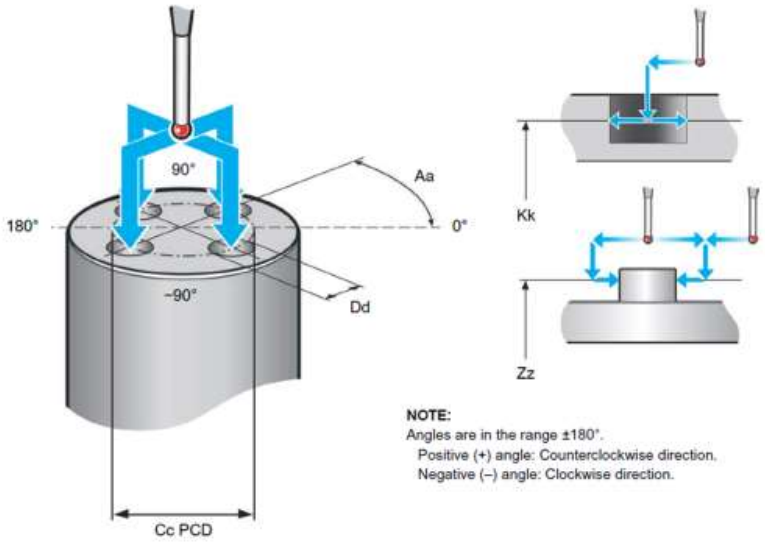


Macro O9819 → Bore/Boss on PCD Measurement

Option input Information:

Aa. → The angle measured from the X-axis to the first Bore/Boss. Default value is 0.

Bb. → The number of features on the PCD. Default value is 1.



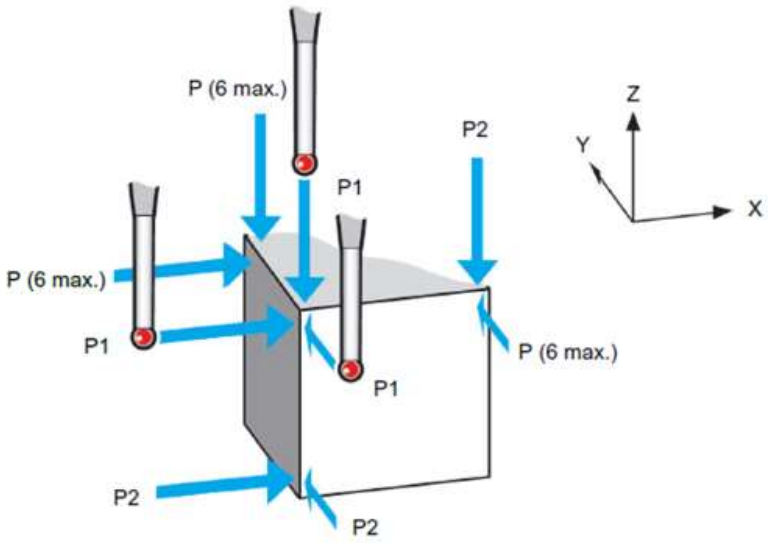
Ex. Measuring 4 holes on a PCD

1. T20 M6	1. Select the Probe
2. G54 X0. Y0.	2. Start position
3. G43 H20	3. Activate tool offset
4. G65 P9832	4. Probe start up program (This includes M19)
5. G65 P9810 Z0.375 F120.	5. Protected positioning move to .375" above plate
6. G65 P9819 A45. B4. C2.5 D0.625 K-.375	6. Measure four 0.625" diameter holes starting at 45°
7. G65 P9832	7. Turn probe back on to
8. G65 P9810 Z2.5	8. Protected positioning move
9. G65 P9833	9. Probe finish
10. G91 G28 Z0.	10. Reference return

Macro O9820 → Stock Allowance

This cycle will measure a single surface (XYZ) at defined positions to establish the maximum and minimum stock condition of the surface. The probe should be positioned at the first point (P1) to measure the surface. Up to 6 points in total can be measured per cycle. Some things to note:

1. When setting a work offset, the surface position is at the minimum measured position and the value will be stored in #146
2. When a work offset is not set, the nominal position is assumed, and the maximum and minimum values are stored in #144 and #145



Macro O9820 → Stock Allowance

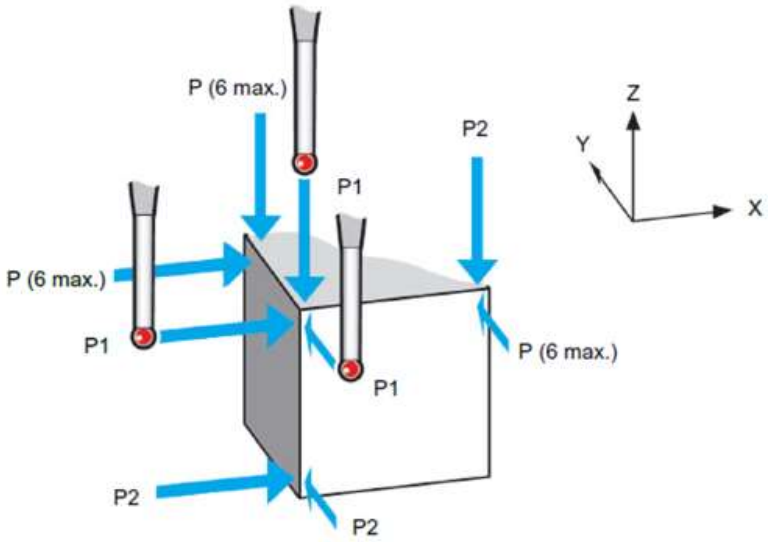
The format for this is:

X-Surface Measure
G65 P9820 Xx. [Jj. Kk. Ss. Uu. Qq.]

Y-Surface Measure
G65 P9820 Yy. [Ii. Kk. Ss. Uu. Qq.]

Z-Surface Measure
G65 P9820 Zz. [Ii. Jj. Ss. Uu. Qq.]

Note: Successive pairs of Ii, Jj, and Kk values must be in order for P2 to P6



Macro O9820 → Stock Allowance

Optional Inputs:

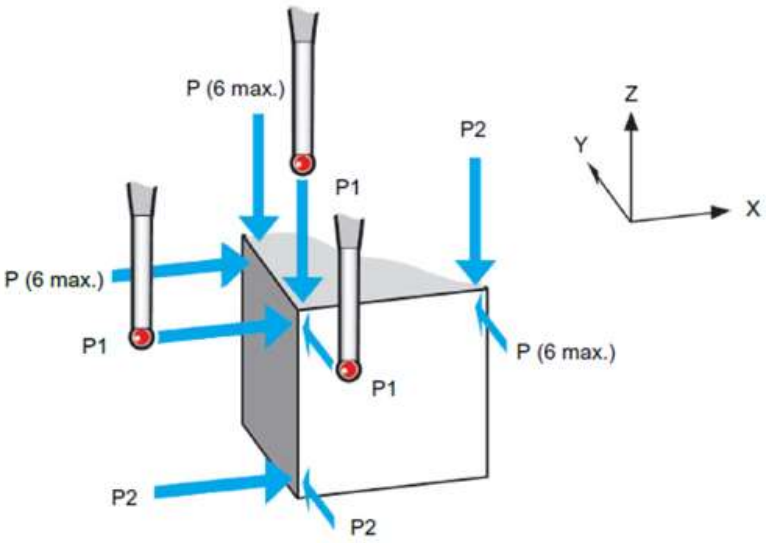
I1(P2) to I5(P6) → The X surface positions for P2 to P6

J1(P2) to J5(P6) → The Y surface positions for P2 to P6

K1(P2) to K5(P6) → The Z surface position for P2 to P6

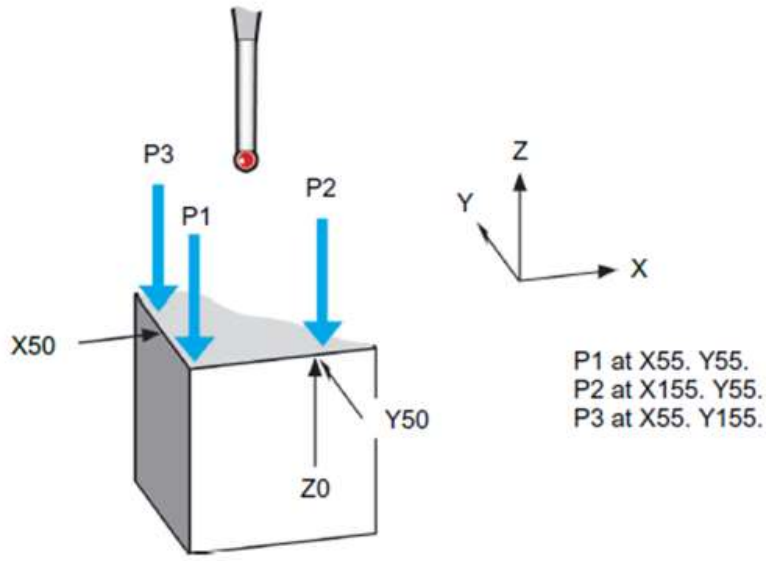
Uu. → The maximum stock allowance or upper tolerance

1. Uu. Input only will act as the upper tolerance
2. Uu. with Ss. input will act as the maximum stock allowance



Ex. Measuring an Angled Web

1. Select the probe	1. Select Probe
2. G65 P9810 X55. Y55. Z20. F3000.	2. Protected positioning
3. G65 P9820 Z0. I155. J55. I55. J155. U1.	3. Measure P1, P2 and P3 with a 1mm tolerance
4. Continue machining	4. Continue machining



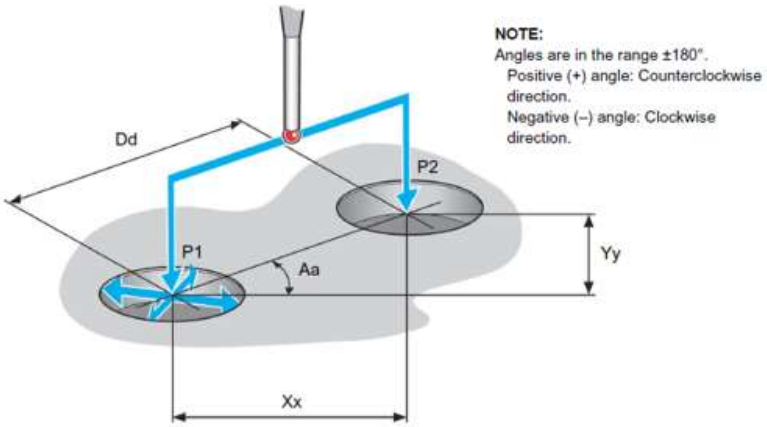
Macro O9834 → Determining feature-to-feature data in the XY plane & Z plane

There is no movement in this cycle. It is used after running 2 measuring cycles to determine the feature-to-feature data. The data for P1 and P2 must already be stored in variables #130 to #134 (P1) and #135 to #139 (P2) by running suitable measuring cycles.

Note: The order of P1 and P2 is important because the data calculated is P2 in reference to P1

Values for P1 are obtained by programming a G65 P9834 without any inputs after the first measuring cycle.

Values for P2 are obtained by running a second measuring cycle. This will establish the feature-to-feature data when programming G65 P9834 with suitable inputs after the 2nd measuring cycles



Macro O9834 → Determining feature-to-feature data in the XY plane

The format for this is:

G65 P9834 Xx. [Ee. Ff. Hh. Mm. Ss. Tt. Uu. Vv. Ww.]

Or

G65 P9834 Yy. [Ee. Ff. Hh. Mm. Ss. Tt. Uu. Vv. Ww.]

Or

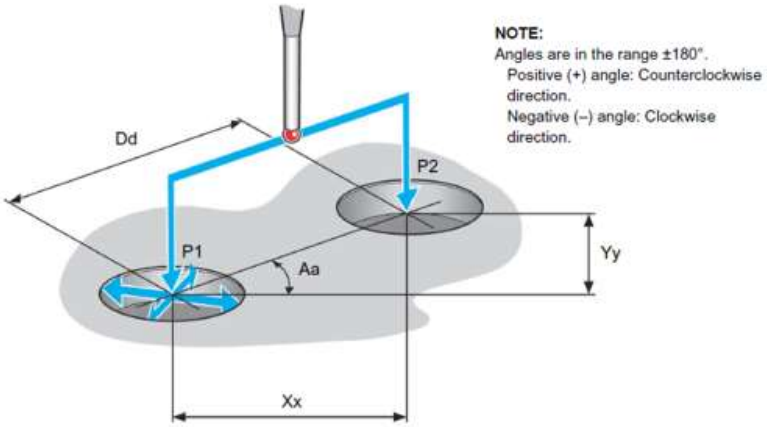
G65 P9834 Xx. Yy. [Bb. Ee. Hh. Mm. Ss. Uu. Ww.]

Or

G65 P9834 Aa. Dd. [Bb. Ee. Hh. Mm. Ss. Uu. Ww.]

Or

G65 P9834



Macro O9834 → Determining feature-to-feature data in the Z plane

The format for this is:

G65 P9834 Zz. [Ee. Ff. Hh. Mm. Ss. Tt. Uu. Vv. Ww.]

Or

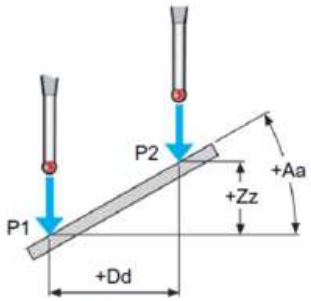
G65 P9834 Aa. Zz. [Bb. Ww.]

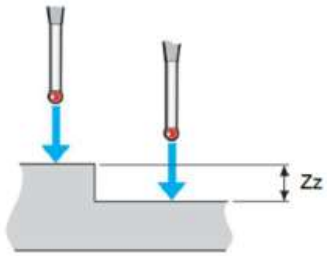
Or

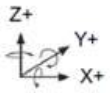
G65 P9834 Dd. Zz. [Bb. Ww.]

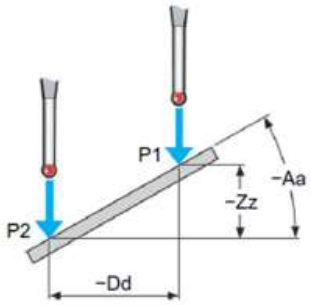
Or

G65 P9834









NOTE:
Angles are in the range ±180°.
Positive (+) angle: Counterclockwise direction.
Negative (–) angle: Clockwise direction.

Macro O9834 → Determining feature-to-feature data in the XY plane & Z plane

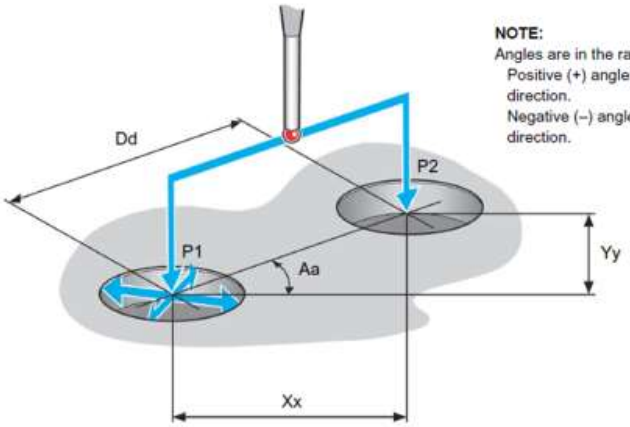
Format Notes:

1. Updating a tool offset with the T input is possible only if O9811 is used for the P2 data. Otherwise a "T INPUT NOT ALLOWED" alarm will appear

2. This cycle cannot be used in conjunction with the Web/Pocket cycles (O9812)

3. Angles, the XY plane is with respect to the X+ axis direction. Use angles in the range ±180°

4. When G65 P9834 (without inputs) is used, the following data is then stored
   From #135 to #130
   From #136 to #131
   From #137 to #132
   From #138 to #133
   From #139 to #134



NOTE:
Angles are in the range ±180°.
Positive (+) angle: Counterclockwise direction.
Negative (–) angle: Clockwise direction.

Macro O9834 → Determining feature-to-feature data in the XY plane

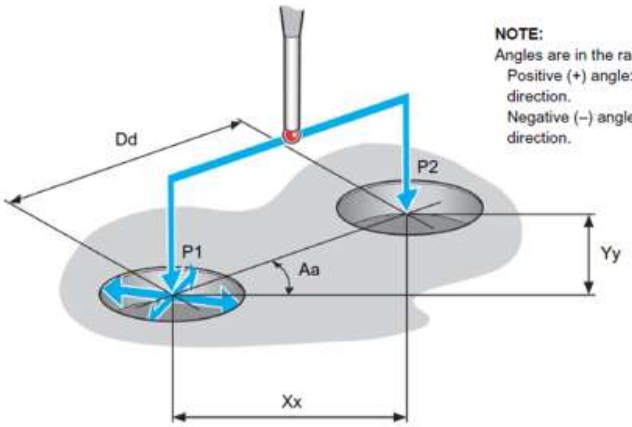
Compulsory Inputs:

Aa → The angle of P2 with respect to P1 when measured from the X+ axis

Dd → The minimum distance between P1 and P2

Xx → The nominal incremental distance in the X axis

Yy → The nominal incremental distance in the Y axis



NOTE:
Angles are in the range ±180°.
Positive (+) angle: Counterclockwise direction.
Negative (–) angle: Clockwise direction.

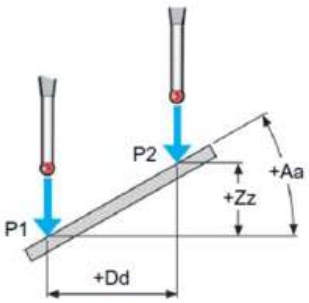
Macro O9834 → Determining feature-to-feature data in the Z plane

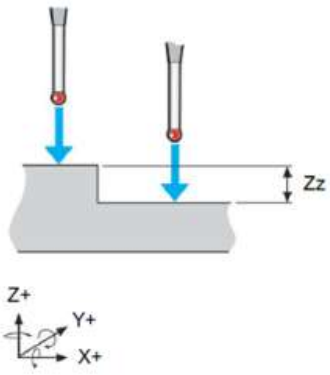
Compulsory Inputs:

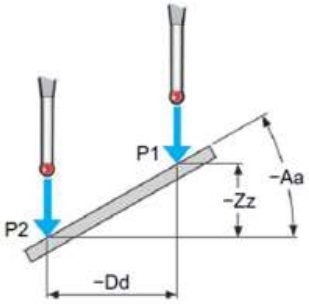
Zz.→ The nominal incremental distance in the Z axis
Aa.→ This is the angle of P2 with respect to P1 measured Z plane

Zz.→ The nominal incremental distance in the Z axis
Dd.→ The minimum distance between P1 and P2 measured in the XY plane

Zz.→ The nominal incremental distance in the Z axis







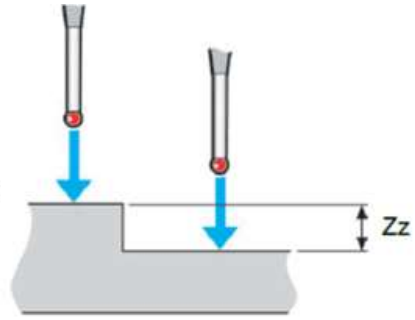
NOTE:
Angles are in the range ±180°.
Positive (+) angle: Counterclockwise direction.
Negative (–) angle: Clockwise direction.

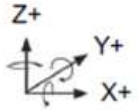
Ex. Measuring a Surface to Bore (XY Plane)

1. Select probe and probe offset	1. Select probe and probe offset
2. G65 P9810 X0.375 Y2. F120.	2. Protected positioning move
3. G65 P9810 Z-0.375	3. Protected positioning move
4. G65 P9811 X0.	4. P1 at X0." position
5. G65 P9834	5. Store the data
6. G65 P9810 Z0.375	6. Protected positioning move
7. G65 P9810 X-2.	7. Move to the new position
8. G65 P9810 Z-.375	8. Protected positioning move
9. G65 P9814 D0.75	9. P2 0.75" bore
10. G65 P9834 X-2. H0.2	10. Measure the distance -2."

Ex. Measuring the incremental distance between 2 surfaces (Z Plane)

1. Select probe and probe offsets	1. Select probe and probe offsets
2. G65 P9810 X1.1875 Y2. F120.	2. Protected positioning move
3. G65 P9810 Z1.1875	3. Protected positioning move
4. G65 P9811 Z0.75	4. P1 at 0.75" surface
5. G65 P9834	5. Store the data
6. G65 P9810 X2.	6. Move to the new position
7. G65 P9811 Z.625	7. P2 0.625" surface
8. G65 P9834 Z-0.1875 H0.1	8. The feature to feature is at 0.1875"





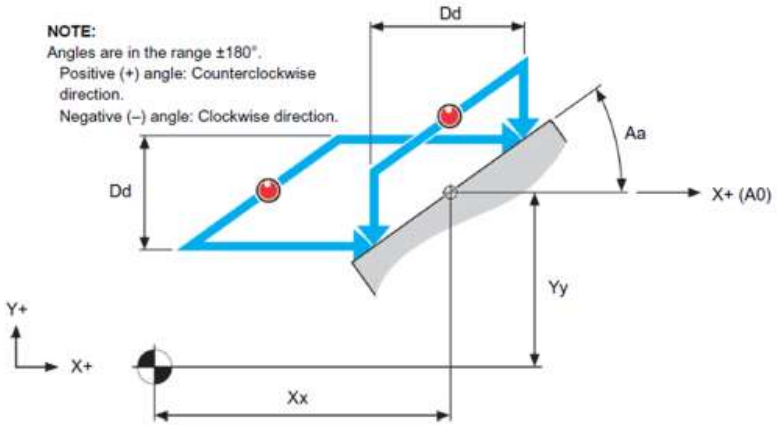
Macro O9843 → Angle Measurement in the X or Y Plane

This cycle will measure an X-axis or Y-axis surface at 2 positions to establish the angular position of the surface. To begin this cycle, position the probe adjacent to the surface and low enough that largest diameter of the probe will hit.

The format for this is:

G65 P9843 Xx. Dd. [Aa. Bb. Qq. Ww. Zz.]

G65 P9843 Yy. Dd. [Aa. Bb. Qq. Ww. Zz.]



Macro O9843 → Angle Measurement in the X or Y Plane

Compulsory Inputs:

Dd. → The distance moved parallel to the commanded axis between the 2 measuring positions

Xx. → The mid-point position of the surface.

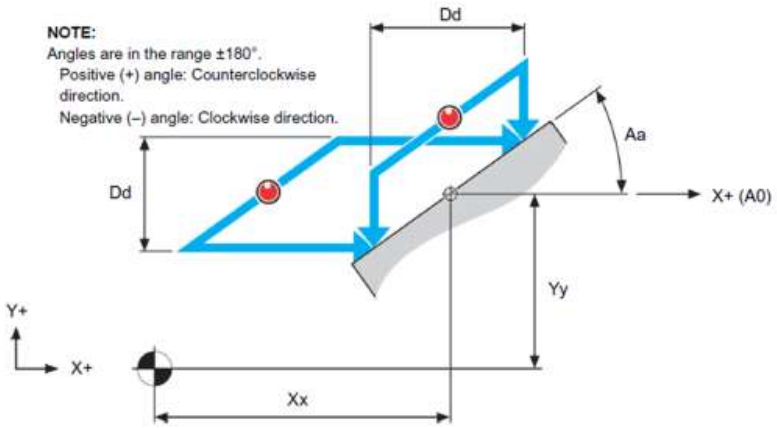
Yy. → The mid-point position of the surface

Optional Inputs:

Aa. →The nominal angle of the surface. The angle range is ±180° and measured from the X+ axis direction

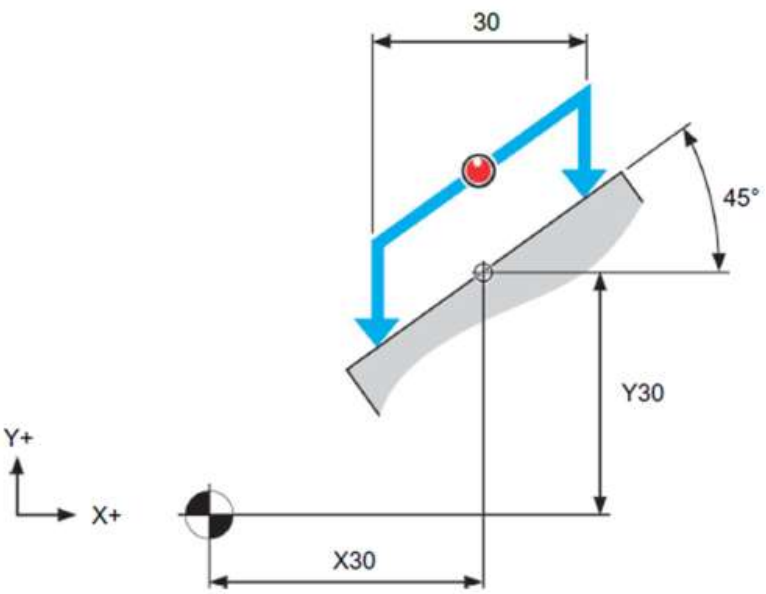
- X-axis default angle is 90°
- Y-axis default angle is 0°

Zz. → Using this input will bring the probe down before taking a measurement. This will allow this cycle to be preformed while avoiding obstacles



Ex. Measuring an angled surface

1. Select probe and probe offsets	1. Select probe and probe offsets
2. G65 P9810 X30. Y50. Z100. F3000.	2. Protected positioning move
3. G65 P9810 Z-15.	3. Protect positioning move to start position
4. G65 P9843 Y30. D30. A45.	4. Angle measurement
5. G65 P9810 Z100.	5. Retract to a safe position



DPRNT

This can be used to output information such as probe data, cycle times and part counts. This information can be sent to an external device from your HAAS machine.

- Settings 261-263 are all used to influence DPRNT
- Setting 261 - Enables to choose what kind of location you would like to output the information to
- Setting 262 - Tells the machine where the program should be stored, this can be set in the “List Programs” mode
- Setting 263 - Is the port number if you would like to out put the information wirelessly to your computer